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# DIALOG

I've been giving serious thought to getting myself a Macintosh. I've tried one in the store and it looks pretty decent. Thing is, I know that most of the hassles people have with systems don't show up until long after they get 'em home. What should I know that the ads don't tell me?

That's a shotgun question if ever there was one. What do you want to use this here Mac for?

Well, for most of the things people get computers for. I want to do some word processing, some programming, maybe call some bulletin boards...

The Mac is an innovative machine, to be sure... I'm not sure if I'd qualify it as the ideal all purpose computer. Its marvelous user friendliness comes with a generous helping of limitations and restrictions.

#### Such as...

To begin with, the Mac's superb graphics are possible because it uses a very capable processor. This doesn't make them particularly easy, though. In fact, as a rough comparison, when you take the processor overhead needed to run the computer's "background" functions away from its overall capability it's not that much more powerful than even a full house eight bit system.

#### It has more RAM.

Granted, it does. However, 68000 programs tend to be much larger than those written for, say, a Z-80. Some of that RAM will not be available to you for this reason.

# It has a much more flexible screen display than any eight bit machine.

Unquestionably, and if screen graphics... albeit black and white ones... are your primary concern you can do no better than a Macintosh. However, you should consider what you are planning to do with those incredible graphics.

#### Well, to begin with, there's MacWrite. It would let me do all sorts of fancy fonts and type styles for letters, headings, titles, stuff like that...

Yes, MacWrite is a party to use. However, it has several decided limitations as a word processor. Again, if you remove the Macintosh dependent toys... in this case the neat typefaces... and compare it to software written for more commonplace machines it would qualify as a pretty low rent package.

#### What about third party software for the Mac?

We're starting to see the first dribbles of this, but I think that the ultimate deluge will be a while in coming. Quite a lot of good software starts off in people's basements, rather than coming from established software development houses. This will be especially true for innovative applications for the Mac beyond the usual word processors and spreadsheets. In order to develop such software, one needs programming languages... something which Apple was pretty tight on until just recently.



# I think the graphics make up for quite a number of its weaknesses.

Yes, I would agree... assuming that you need them. I found, in using MacWrite, that after the initial playing period wore off I got pretty sick of looking at manuscripts that resembled ransom notes cut from old newspapers. There is a decided tendency to overuse the features of MacWrite.

# Are there any good serious packages coming out for the $\operatorname{Mac}$ ?

There are. We've seen things like Microsoft BASIC, several better word processors, Multiplan and so on. However, most of the stuff that has been appearing has been in the sphere of small utilities and interesting programs of indeterminate usefulness. I think that a lot of it is enjoying an artificially grand popularity because there is such a dirth of Mac software.

#### What are good reasons for buying a Mac, then?

The Macintosh is the perfect computer... well, make that a very good choice... for people who know nothing about computers, want to know even less but, at the same time, require access to the power of specific computer software. It's unquestionably the best box for idiots we've seen.

It's also a great computer for people who just get off on using very clever new technology. There's nothing really wrong in this... it makes life very easy and uncomplicated.

I think that the Mac is the wrong choice for users who are not afraid to learn to use complex software and plan to make extensive demands of it. None of the Mac applications we've seen to date have been poorly written, but all of them have run up against the limitations of both the hardware and the requirement of using all the Mac's icons, menus and other paraphernalia.

Experienced users, or ones who plan to make enough use of the computer to get there in time, will eventually find the Mac extremely frustrating.

#### It sounds like a good machine that I'll grow out of soon.

That depends a lot on how much you figure on growing. It's certainly the least likely machine to turn you off computers at the start... it just may not keep you turned onto them as long as a more conventional... and flexible... system would.

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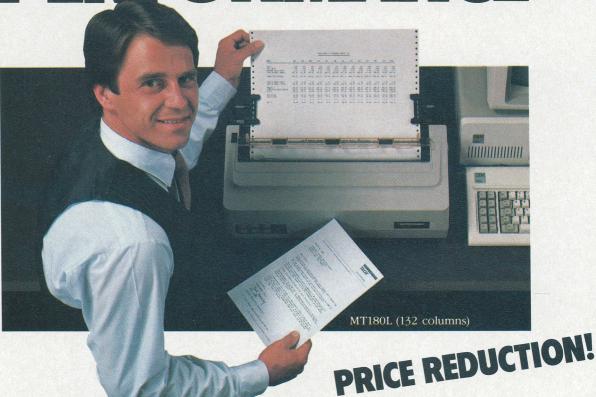
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# COMPUTER PRESS

# Software R&D

VANCOUVER, B.C. — The Canadian Association of Data Processing Service Organiza- ment costs. tions feels that the costs incurware designed for sale to third parties should be tax deduct-

President Bill Boggs, dur- research.

ing a meeting in Vancouver, stated that the federal government had been urged by the association to change its policy regarding software develop-

The association feels that, red in the development of soft- excepting post-sale maintenance costs, software development can be categorized, and should be tax deductible, as

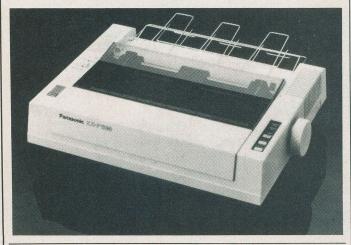
#### **Panasonic News**

puting products are being released by Matsushita Electric of Canada, Limited under the company's brand name of Panasonic.

Two new dot matrix printline will be expanded with higher capability models, as

MISSISSAUGA, ONTARIO well as a letter quality printer - An array of business com- line and a line of microcomput-

Matshushita presently produces a handheld computer, The Link, and expects to be marketing an 8088-based transportable IBM compatible ers are available now, and that micro, pending government approval.



# Important \ Notes

tember computer survey, of Music, 210 Bloor Street Micro Bazzar was listed as the West, Toronto, Ontario M5S Canadian distributor for Kay- 1T8 (416) 961-3111. Besides bepro computers. The distribut- ing helpful and knowledgeable, orship is, however, shared by the lads at Remenyi are rather Computron. Interested parties closer than California. can contact Computron at NOTE TO READERS (403) 482-7363; or 55 Torbay Road, Unit 2, Markham, Ontario L3R 1G7 (416) 477-0828. for any inconvenience this causes.

The Syntauri software for the Classic music system reviewed in the September issue of Computing Now! is available in In our Computing Now!'s Sep- Canada from Remenyi House

either 10641-123 Street, Ed-covers in the Directory of monton, Alberta T5N 1P3 Microcomputer and Electronic Retailers in Canada dividing computer and electronic outlets were reversed in printing. We apologize

## Contest Winner

COMPUTING NOW! - The response to the First Computing Now! Summer Contest in the July 1984 issue of CN! was incredible. From the mass of mail we received, the entry of Albert Lee of Pinawa, Manitoba was randomly drawn.

Albert wins the Smith Corona L1000 daisy wheel printer for his 14 line program that correctly computes and prints all 70 perfect numbers from 10 to 1000.

# Reader **Supplied** Wombat

Among the rich and flowing tapestry of unusual zoology that flows through the pages of Computing Now! each month, the proud, gracious wombat figures quite prominently. A long time CN! reader, William Patterson, recently returned from Australia... which is where wombats live... and sent this photograph along.

This is a mature wombat, which Bill discovered staring greedily at the "aborigine surprise" breakfast he had been served outside the cave his travel agent had booked him



into. Wombats are not stupid, despite their fairly thick appearance and, upon realizing what it was contemplating, this specimen quickly glanced at its watch saying "Sorry, mate... I forgot the time. Must run... I've tickets to the kangaroo roast in Tasmania."

Now you know what they really do look like.

Continued on page 83

# Next Month In Computing Now!

#### PC Now! Strikes Again

The IBM PC suppliment we featured in our June 1984 edition of Computing Now! brought us a lot of good vibes from our readers so we've decided to do it again. The November PC Now! will feature a complete survey of all the IBM compatible systems... a lot of them have changed since the last time we scanned 'em. We'll also be looking at some of the more sophisticated approaches available for programming the creature. If you own an IBM PC or a compatible system... or if you're just considering buying one... your piteous spirit will haunt the Earth for millennia in abject sorrow if you miss this issue. Really.

#### Ice Sutherland's Rodent Ranch

Up to his naval in computers, the always mythical lord Sutherland donned peasant garb one day and left his castle incognito. He journeyed far across the countryside seeking fulfillment until finally, he realized that his destiny was to become a mouseherd. The result of all this was the JLS mouse, a PC peripheral which, unlike most mice, plugs in between the keyboard and the computer, simulating the cursor movement keys in response to the scurrying of the trackball. It's a party.

#### **Eight Inches for Fruit**

The Apple's microscopic disk drives have always been among its most severe limitations. Next month we're going to look at adding new drives... bigger, finer drives... to the Apple. The new controller card allows for double sided double density drives each holding somewhat over a megabyte... where once there was scarcely more than a hundred K.



A hundred years ago countries operated largely independently of each other. National boundaries... and certainly geographical barriers, such as oceans... were quite good at isolating ideas and fashions.

Contemporary fads tend to be global. Something achieving popularity in one country can be reasonably expected to make its way through most of the Western world. As examples we have CB radio, skate boards, digital watches and so on. To the casual observer it seems to be the same with microcomputers. It isn't as simple as that, however.

Watchers of the North American computer industry will probably find concensus in one conclusion at least... things are extremely fluid at the moment. It would be foolhardy at best to offer any decisive predictions about where things are going. This is an issue of some concern to businesses whose financial existences are based on the directions computers take.

An accurate prognostication of the nature of the next generation of microcomputer development will also be of interest to users of computer technology, if only for the satisfaction of knowing that one's equipment is not about to be rendered obsolete.

The difficulty one has in arriving at such a conclusion is a result of microcomputers not really being a fad, such as CB radios and skate boards, but more of a social watershed, such as television. It has been a long time since there has been one of these... there is nothing, really, to measure it against.

For observers wishing to get some sort of handle on the North American computer industry it may prove valuable to have a look at how things are doing in a similar social environment. Perhaps the best example would be microcomputers in Great Britain.

#### Union Jack But No Jane

The use of computers is big in Britain, probably bigger than anywhere else in the world if you deal only in numbers. However, clearly, it has developed very differently from the situation in North America.

One cannot fail to be impressed by the widespread influence of computers in Britain. The small town near where I was staying, Harwich, having a population of perhaps ten thousand, has two dedicated micro stores plus two chain outlets with computer sections. Harwich is about twenty miles from a much larger city, itself with at least twenty computer stores.

Even the British equivalent of the convenience store, the local tobacconist

newsagent, will often have software for sale.

Microcomputing also has its own dedicated radio and television shows. Several of the national papers have major columns or sections devoted to microcomputers.

#### **BUSINESS SYSTEMS**



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APRICOT "Portable Executive Computer". 16 Bit Micro. 256K RAM. up to 1.44 megabytes floppy disk storage. 3½". Sony disks. Portable brief case styling. Modem with auto dialler (optional) hard disk optional. Vast software library (compatible with Strius 1).

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SIRIUS 1 Sirius 1 Computer with 128K RAM and 1.2 megabyte Floppy disc storage including CP/M 86. MS DOS and Microsoft Basic £2195 + VAT

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TOPECH COMPUTER with colour monitor includes Twin 400K disks. Torchne Operating System free perfect software (perfect writer, perfect speller perfect called the perfect dier). Torchmail Plus (Electronic Mail). Torch Mars (Financial modelling with graphics). Torchtel (Viewdata Access System). Executive And (Mehru System). Datel 600 (Link to outside mainframe services i.e. "electron Gold).

TEXAS INSTRUMENTS PROFESSIONAL COMPUTER
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possible TI speech command hardware option brings a new level of user
friendliness to computing. Allows voice operated keyboard control
(Optional)

MAINTENANCE CONTRACTS ARE AVAILABLE.

Figure 1. This mail order ad from a British magazine gives a fair idea of the prices of things. The exchange rate is about \$1.75 to one pound. VAT is sales tax (15%) and this ad is unusual in that it is not included in most prices. The photographs were just as bad in the original as they are here.

The estimates of the numbers of systems in use vary greatly, ranging from two and a half to five million. Even the lowest estimate would mean that "computer saturation" is three times that of what it is in Canada per head. If there are any signs that the popularity of computers has reached its peak, I didn't see them.

The differences between these two computer industries are however much greater than just numbers. Britain represents a huge home computer market concentrated at the lower price end. The first clue to this is in the tobacconist

newsagents. The software they are selling is virtually all on cassettes and nearly all games. The magazines seem to be heavily biassed toward games both in their editorial and advertising.

A closer investigation reveals that there is also a lot of interest in programming and, although games seem to dominate, there is still a lot of interest in other areas.

#### Hardware

The brand names of many of the computers will seem strange to North American eyes. The weekly computer magazines...there are three of them... each produce a popularity chart for both hardware and software much like the music charts. From this it appears that the top selling computers are the Sinclair Spectrum, the BBC microcomputer, the Acorn Electron and the more familiar VIC-20. With the exception of the PC jr, all the major names from the States and Japan are available but only Commodore with the VIC-20 and the 64 have any significant market share.

At the expensive end, the IBM PC has failed to capture the imagination as it has here. This may be because of the current exchange rate, making American imports expensive, or because the British do not seem to hold imported technology in awe. The PC is not seen as the only safe choice for business. At this end of the market a machine known as the Apricot seems to be doing well. A review on television rated it better than the PC.

In Canada we would assume that anything called an *Apricot* would be an *Apple clone* but in fact it is MS-DOS based. The British don't use the word "clone" but, rather, "work-alike" which, I suppose is an equally good description.

If clones are available, I didn't come across them or anyone who knew much about them.

The average cost of the popular computers in Britain is rather lower than it is here. This is not because computers are cheaper than they are in Canada... for a given model they they cost roughly the same, although quoted prices always include a fifteen percent sales tax... but the volume market is for the less expensive models. The Spectrum... with colour, sound and forty-eight K... sells for about two hundred and twenty-five dollars. At the higher end of the popular range is the BBC micro with thirty two K of memory at about seven hundred dollars.

Disk drives are much rarer in Britain than they are in Canada. Cassettes dominate as the popular mass storage

# **Computers Across the Pond**

medium, even in some business applications... including word processing.

A lot of Spectrum owners, the largest group, consider the first stage of upgrading from a cassette to be a "microdrive", a fast cassette type streamer costing well under half that of a disk. These hold eighty-five K each and are claimed to give an typical access time of three and a half seconds. They will load a forty-eight kilobyte program in nine seconds. Eight microdrives...each costing just under ninety dollars... can be hooked up to each interface.

The British also use monitors far less than we do. The television set is the standard. Again, this applies to business use as well as in the home. The Commodore 64 ... attached to a standard broadcast receiver... has succeeded in projecting itself as a business system. I even came across one company using several of them as word processors

The product that is exciting people at the moment is the Sinclair QL... that stands for "Quantum Leap". It features a hundred and twenty-eight K of memory and two microdrives. It comes bundled with a spreadsheet and word processing software. The whole package costs the equivalent of about seven hundred dollars. Although announced at the beginning of 1984, deliveries have only just started.

Magazine reviews of the QL are generally favourable but it has been criticised for being slow. It was originally announced that this would be launched in the States this fall at under five hundred dollars. There are, however, reports of major production problems. Don't hold your breath.

#### Software

The average cost of cassette software in Britain was about twelve dollars until recently but severe competition is reducing this. One major distributor has cut its line to about three and a half dollars per tape, reportedly to try to overcome software piracy

Piracy has become just as serious a problem in Britain as it is here. It is very hard to protect cassettes as they can so easily be copied as audio programs. Of the software in use, about ninety-five percent is pirated according to the software publishers.

Even so, some six million cassettes are expected to be sold in 1984.

In general people do not think much about operating systems. In talking to a teacher about this, I had to explain what CP/M and MS-DOS were. To confirm that this was not isolated, the television show that reviewed the Apricot, made no mention that it used MS-DOS, a parameter we would consider very important.



The Unique Z.A Nucroarive system ses une ZS Spectrum apart from all Other computer systems. At a fraction of the cost of floppy discs, it gives fact access to 85K of program and data on Microdive cartridges. And it opens up exciting possibilities through an RS232 interface and local area network.

## ZX Microdrives – the fast way to save or load 85K of program and data. £49.95

load 85K of program and data. £49.95
ZX Microdrives are controlled by ZX Interface 1.
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ZX Microdrives use the Spectrum's own power supply.

Supply.

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With memory like that, the possibilities are limities—stock control, word-processing, even huge adventure samed!

limiues - sacures adventure games!
With each Microdrive, you'll receive a Microdrive connector and Microdrive demonstration

cartridge. Blank Microdrive cartridges cost £4.95 each. They are available in packs of 4 (with a free cartridge wallet) or singly.

#### ZX Interface 1 - the multi-purpose controller. £49.95

ZX Interface 1 is a multi-purpose device. It controls up to 8 Microdrives. And it adds file-handling and communication facilities to your Spectrum.

So in one low-priced unit, you also get these two built-in features:

RS232 Interface This industry standard interface allows you to link your Spectrum with full-size printers, communicate with other computers employing RS232, and transmit data over telephone lines us a soudcase.

innes via modems.

The ZX Net Now you and your friends can transfer programs and data on a local area network—or even play computer games together.

The ZX Net makes it easy, and fast!
It links between 2 and 64 Spectrums, transmitting at 10,000 characters per second. (So a full screen is transferred in around 3 seconds) With the ZX Net, only one person need type in a program And a Microdrive or printer can be shared by everyone in

croanive or printer can be shared by everyone in network! ZX Interface 1 offers you all these facilities, and ins the same peripheral port as the Spectrum

With each ZX Interface 1, you'll receive a connecting lead for the first Microdrive; a ZX Net

lead with jack plugs; plus a comprehensive manual. An RS232 lead is available as an optional extra at £14.95.

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Find out more - in your local shop!

Find out more – in your occa snop: The best way to evaluate ZV Microdrives and Interface 1 is to see them for yourself. There is a full range of ZV peripherals–including ZV Interface 2 for joystick and ROM Cartridge capability, alongside the only computer that supports them – the ZV Spectrum!

For more information, telephone Sinclair Research Ltd, on 0276 685311. Sinclair, ZX, ZX Spectrum, ZX Microdrive, ZX Net and ZX Interface are trade marks of Sinclair Research Ltd.



Figure 2. The microdrives from Sinclair are not true disks but fast cassette streamers. The interface for the popular Spectrum system, capable of handling up to eight drives, costs about \$87 as does each drive. The access time is claimed to be typically 3.5 seconds.

The exception to this lack of interest is the excitement about MSX, a new standard for low end systems adopted by many Japanese builders which will entail having all cassettes interchangeable. No MSX systems are available at this writing... the first are expected in September. These are expected to have a major impact on the

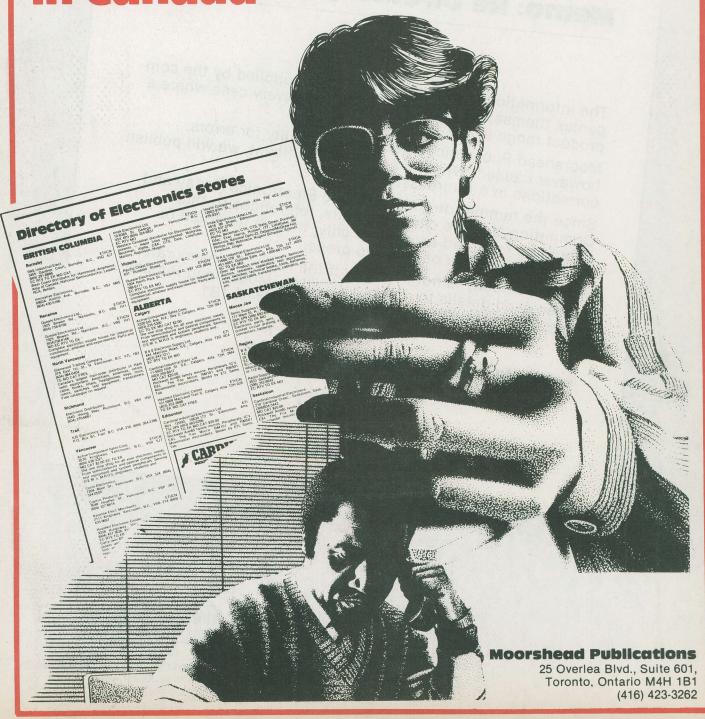
The dominance of cassettes has one interesting sideline.

One of the television programs concerning microcomputers has no title music... instead it broadcasts programs on the audio channel. They tell you which system the program being transmitted is for but not what the program does. I couldn't find anyone who had actually tried to use any of this "airware".

The radio shows also put out software over the air. Educational programs are also distributed in this manner.

# **FALL** 1984

Directory of Electronic Retailers in Canada



# **Memo: Re Directory Listings**

The information in this directory is that supplied by the companies themselves in most cases and in every case where a product range is mentioned.

Moorshead Publications accepts no liability for errors, however caused. Where an error is significant, we will publish corrections in a future issue.

Since the number of outlets selling Electronics Today and Computing Now! is changing daily, references to this should be regarded as a guide only, though it should be correct at the time of going to press.

If your company is not listed, or if the listing is inaccurate, please send details to: Directory Listing, Moorshead Publications, 25 Overlea Blvd., Toronto, Ontario, M4H 1B1.

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#### **BRITISH COLUMBIA**

#### **Abbotsford**

Radio Shack 33655 Essendene Avenue, Abbotsford, B.C. V2S 2G5 (604)853-7221

#### Burnaby

Compucentre 9855 Austin Ave., 304 Lougheed Shopping Mall, Burnaby, B.C., V3J 1N4 (604) 421-5151 Personal computers from IBM PCjr, Commodore 64, Coleco Adam plus complete line of peripherals, accessories and software for business, entertainment and education applications. Large variety of books and third party vendor products.

Computerland 214-4501 North Road, Burnaby, B.C., V3N 4R7 (604)421-7557

Eaton's Business Centre 4567 Lougheed Highway, North Burnaby, B.C., V5C 3Z7 (604)299-5511 Ext. 322 Computers from IBM, Apple, and Zenith. One of the widest selections of business, educational, and entertainment software. Training courses, leasing and financing are all available.

H&S Microsystems
125-5665 Kingsway, Burnaby, B.C., V5H 2G4
(604)430-4145
MO CAT FREE
Sales & service of PC compatibles & service to
Radio Shack Mod. 1,3,4.

Logistics 7053 Buller Ave., Burnaby B.C., V5J 4S1 (604)437-9919

Mai Canada Ltd. 3rd Floor, Central Plaza, 4370 Dominion, Burnaby, B.C., V5G 4L7

Orion Computer Systems Ltd. 5480 Pandora St., Burnaby, B.C., V5B 1M1 (604)291-8141

R-A-E Data Systems Div. S455 Gardner Court, Burnaby, B.C., V5G 4J7 (604)291-8866 MO CAT

Wholesale/Retail distributor of Data General 'Desktop Generation' and 'Nova' 16 bit computers and peripherals.

Xerox 5172 Kingsway, Burnaby, B.C. V5H 2E8. (604)430-4535

#### Campbell River

Island Microsystems 151 Beech St., Campbell River, B.C., V9W 5G4 (604)286-0624 Sales, service, courses, and programming. Represent North Star, Otrona, Corona, Kaypro and Commodore.

#### Castlegar

Castlegar Computers 2217-10th Ave., Castlegar, B.C., V1N 2Z8

Castlegar Computers 619 Columbia Ave., Castlegar, B.C., V1N 1G9

#### Clearbrook

Computer Age 2451 Clearbrook Road, Clearbrook, B.C., V2T 2Y1 (604)859-4151 Authorized Apple, IBM Personal Computers, Okidata, Transtar, Brother dealer. Specialize in business, professional and education.

#### Coquitlam

Computer Innovations 100-2929 Barnet Hwy, Coquitlam, B.C., V3B 5R5

Paragon Computer Group Ltd. 567 Clarke Road, Coquitlam, B.C., V3J 3X4 (604)939-6461

Radio Shack 435 North Road, Cariboo Shopping Centre, Coquitlam, B.C., V3K 3V9 (604) 931-7533 Radio Shack TRS-80 Models II, III, 16 and colour computers. Hardware and software for each, plus all related peripherals.

#### Courtenav

Sandpiper Computer Systems CN 280 - 4th Street, Courtenay, B.C., V9N 1G6 (604)338-0121 MO Apple authorized dealer, Olivetti, Epson, Vector

Apple authorized dealer, Olivetti, Epson, Vector Graphic, business systems & support, software (Accounting, educational, games, utilities).

#### Cranbrook

Cranbrook Computer Mart 114 Cranbrook Mall, Cranbrook, B.C., V1C 3L1 (604)489-6244

Cranbrook Photo & Computers Ltd. ETI/CN 800 Baker St., Cranbrook, B.C., V1C 1A2 (604)489-5336

Franklin Ace 1000, Corona (desktop and portable). Printers, peripherals, software (Apple & IBM)

Roberts Computer Systems 1139-D Industry Rd. #3, Cranbrook, B.C., V1C 5A5 (604)426-3305

Tarus Computers Limited 225 Cranbrook Street, Cranbrook, B.C., V1C 3R1 (604)426-7588 Business and personal computer specialists. Authorized Apple dealer.

#### **Dawson Creek**

NCS Office Equipment 916-102 Ave., Dawson Creek, B.C., V1G 2B7 (604)782-1294

#### **Grand Forks**

KB Computer Centre CN 7383-2nd Street, P.O. Box 1405, Grand Forks, B.C., V0H 1H0 (604)442-3217 MO

Sales and service for Franklin Ace & Columbia Data computers, Okidata & Smith-Corona printers, Sharp calculator products. Apple & IBM compatible software.

#### Kamloops

Conti Computer Systems 439 Seymour St., Kamloops, B.C., V2C 2G7 (604)374-0404

Radio Shack Computer Dept. 450 Lansdown, Thompson Park Shopping Centre, Kamloops, B.C., V2C 1Y3 (604)374-1705

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Dynamic Computer Centre 6-1960 Springfield Rd., Kelowna, B.C., V1Y 5V7 (604)860-7795 Radio Shack 1979 Harvey Avenue, Northgate Plaza, Kelowna, B.C., V17 6G5 (604)860-4426 MO CAT FREE

TRS-80 models 4, 12, 16, CoCo and Tandy-2000 computers. Hardware and software plus related peripheral equipment. We stock the full line.

#### Langley

Net Software Ltd. 5763-203A St., Langley, B.C., V3A 1W7 (604)530-3161

Vulcan Computer Systems 20571 Fraser Hwy., Langley, B.C., V3A 4G4

#### Maple Ridge

Maple Ridge Video 22403A Dewdney Trunk, Maple Ridge, B.C., V2X 7X7

#### Vanaimo

Micro-Vision Electronics 21498 Bowden Rd., Nanaimo, B.C., V9S 1H8

Owen & Sons Computer Centre ETI/CN 52 Victoria Cresc., Nanaimo, B.C., (604)753-4178

Authorized Commodore computer systems dealer. Full inventory of software, hardware and accessories. Servicing of all products done on-site. Victoria & Nanaimo.

Radio Shack 2159 Departure Bay Rd., Northbrook Mall, Nanaimo, B.C., V9S 3V5 (604)758-9595 Radio Shack TRS-80 Models II, III, 16 and colour computers. Hardware and software plus related peripheral equipment.

#### **North Vancouver**

Computer Department of London Drugs Ltd. 2032 Lonsdale Avenue, N. Vancouver, B.C., V7M 2K5 (604)980-3661

Authorized Columbia, Morrow, and Sanyo dealer with a complete line of printers, monitors, modems, software, and accessories. Open 7-days a week.

Macrotech Computer Products Ltd. 1370 Marine Dr., North Vancouver, B.C., V7P 1T4 (604)984-9305
Peripherals for Apple and IBM computers/compatibles. Includes Canadian made memory cards and printer interfaces for Apple //, //+, and //e. Also multi-function, multi-purpose data control unit, accessible by various computers simultaneously (i.e., Apple, IBM).

Paragon Computer Group Ltd. 236 West Esplanade, North Vancouver, B.C., V7M 1A4 (604)985-1331

Tracan Electronics Western Ltd. 1859 Welch St., N. Vancouver, B.C., V7P 1B7 (604)984-4141

#### Penticton

# COMPUTERMANIA

Computer Mania P.O. Box 1045, Penticton, B.C., V2A 7N7 (604)493-4565 / 112-800-663-4143 MO CAT FREE

Specializing in educational software and peripherals for Apple, Commodore & IBM. Sales & service. Largest selection of educational Apple software in Western Canada.



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(604)493-7234
MO CAT FREE
IBM, NEC, Kaypro business systems. Business, educational software and peripherals for IBM, NEC, Kaypro, Apple and Commodore. Printers, Word Processing and Data Processing supplies. Full service facility.

Future World Ventures Ltd. 126-2111 Main Street, Penticton, B.C., V2A 6W6 (604)493-7777

Software for most makes. We carry Atari, Franklin, Kaypro, and Eagle computers.

209 Main S (604)492-5712 Street, Penticton, B.C., V2A 5B1

Radio Shack TRS-80 Models II, III, 16 and colour computers. Hardware and software plus related peripheral equipment.

#### Port Alberni

Compu-Mart 3061-3rd Ave., Port Alberni, B.C., V9Y 2A4 (604)724-4733 MO

Atari, Commodore, and Sinclair computers, and a wide selection of software for Atari and Com-modore machines. Also Percom and Rana disk drives, and Epson printers.

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Datum Electronics Inc. 11-3000 Lougheed Hwy., Port Coquitlam, B.C., V3B 1C5 (604)464-4424 Corvus, NEC APC, Columbia, Apple

#### Port Moody

Sabre Computer Systems 1-2810 St. John St., Port Moody, B.C., V3H 2C1

An authorized service centre offering sales, service and support for business and home computer product lines.

#### **Powell River**

Tomorrowland Computers Ltd. 145-7100 Alberni St., Powell River, B.C., V8A 5K9 (604)485-6960

#### **Prince George**

Northern Computer Concepts 1556-6th Ave., Prince George, B.C., V2L 5B5 (604)563-2263

Authorized Apple dealer. Also dealer for Epson printers, Amdek monitors and IBM accessories.

Radio Shack Computer Marketing Dept. 35-3056 Massey Drive, Pine Centre Mall, Prince George, B.C., V2N 2S9 (604)562-7661

Sight and Sound Computer Centre 657 Central St. West, Prince George, B.C., V2M 3C6 (604)562-0356

Business and personal applications on most major computer products. Dealer for Apple, Commodore, Atari, Corona, Epson and Timex.

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Revelstoke Home and Business Computers Ltd. 215 McKenzie Ave., Box 2550, Revelstoke, B.C., V0E 2S0 (604)837-6363 Authorized Apple dealer. Authroized Eagle com-puter dealer. All major software, peripherals, etc.

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Paragon Computer Group Ltd. 6-4040, No. 3 Road, Richmond, B.C., V6X 2C2 (604)270-8392

Sound Chaser Computer Music Stm. 3331 Jacombs Road, Richmond, B.C., V6V 1Z6

Super Software Inc. CN 103-4600 #3 Rd., Richmond, B.C., V6X 2C2 (604)278-7638 MO CAT FREE

We carry approx. 3,000 software titles in stock for all major micros. Approx. 800 book titles, 50 magazine titles, plus accessories and supplies.

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Digitronic Systems 103 Teredo Square, Box 1897, Sechelt, B.C., VON

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Sidney Compupower 8720 Pender Park Dr., Sidney, B.C., V8L 3Z5

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Sprite Computers Ltd. 10217 King George Hwy, Surrey, B.C., V3T 2W6 (604)581-1244

Star Computer Products 2207 Guildford Town Centre, Surrey, B.C., V3R 7B9 (604)584-1033 MO CAT FREE

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Computer Innovations 1500 West Georgia, Suite 100, Vancouver, B.C.,

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ComputerLand is a full service micro computer retail store selling Apple, IBM, Compaq. We offer authorized service, hot-line support, training, and on-site installtion.

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Data Terminal Mart 614 West 8th Ave., Vancouver, B.C., V5Z 1C8

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We carry Digital, Texas Instruments, Okidata,
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These include computers, software, printers and

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Eaton's Business Centre Vancouver Pacific Centre, 701 Granville St., Van-couver B.C., V6B 4E5 (604)988-6819 Computers from IBM, Apple, and Zenith. One of the widest selections of business, educational, and entertainment software. Training courses, leasing and financing are all available.

Friendly Technology 1161 Melville St., Vancouver, B.C., V6E 2X7

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Future Shop 1066 West Hastings, Vancouver, B.C., V6E 3X3 (604)688-6722

Heath/Zenith Computer Centre ETI 3058 Kingsway, Vancouver, B.C., V5R 5J7 (604)437-7626n Victoria area call: (604)384-7511 MO CAT FREE

Complete line of Heathkit and Zenith Data Products computer products; a variety of plotters, printers, digitizers and modems. Software by Digital Research, Microsoft, Peachtree, IBM and

**IBM Product Centre** 601 Granville, Stock Exchange Tower, Vancouver, B.C., V7Y 1E7

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Kaientai Elect. Merchants ETI/CN 2111 Kingsway, Box 69126, Stn. K, Vancouver, B.C., V5N 2T4 (604)435-9697.

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Networking and Communication specialist for Apple and IBM. Services and distributes modems, hard drives and monitors. Largest supplier of bare boards and accessories for Apple computers.

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Computers: Kaypro, Corona, Televideo, Apple compatible, Commodore, Tava PC, Chameleon. Printers: Gemini, Transtar, Prowriter. Monitors: Amdek, Zenith. Software: IBM, Apple, Commodore, CP/M.

Mr. Chips Computer 511-711 W. Broadway, Vancouver, B.C., V5Z 1J5

Omni Computer Group 1789-999 W. Hastings, Vancouver, B.C., V6C 2W2

Paragon Computer Group Ltd. 236 West Esplanade, Harbour Quay Building, North Vancouver, B.C., V7M 1A4 (604)987-9104

Radio Shack Computer Centre . 685 E. Broadway St., Vancouver, B.C., V5T 1X7 (604)874-3433

tds Computer Solutions Ltd. 689 E. Broadway, Vancouver, B.C., V5T 1X7 (604)875-1221 Retail sales of business systems including hardware and software.

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The T. Eaton Company Ltd. 2555 Nootka St., Vancouver, B.C., V5M 3M4

The Video Station 3673 East Hastings, Vancouver B.C., V5K 2B1

Vancouver Protologic 149 W. 6th St., Vancouver, B.C., V7L 1K4

Wizard Computer Systems 6082 Fraser St., Vancouver, B.C., V5W 2Z7 (604)321-7144

Xerox 1055 Dunsmuir St., Box 49328, Vancouver, B.C., V7X 1L4 (604)684-7511.

#### Vernon

Dynamic Computer Centre 3105D-31st Avenue, Vernon, B.C., V1T 2G9 (604)549-4141 Authorized dealer for Apple, Commodore, IBM, Altos, Onyx and Victor. Full line of computer books, supplies and accessories.

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Computerland 3043 Douglas St., Victora, B.C., V8T 4N2 (604)381-1212 IBM, Digital, Compaq, Apple, Bytec, Nelma.

Computer Innovations 1701 Douglas St., Victoria, B.C., V8W 2G8 (604)383-4455 MO

IBM & Apple //e hardware and software and peripherals.

CompuCanada 2675 Bridge Street, Victoria, B.C., V8T 4Y4 (604)381-3512 CompuCanada - national distributor/representative of best selling microcomputer software and peripheral products for Apple II + IIe, III, Commodore, VIC-20, and 64, Atari, IBM-PC, Coleco and more. East (416)281-3713

West (604)381-3512

Data Terminal Mart 3350 Douglas St., Victoria, B.C., V8Z 3L1 (604)384-3841

Excalibur Systems 2022 Douglas St., Victoria, B.C., V8T 4L1

Heller Computer Systems 1835A Fort St., Victoria, B.C., V8R 1J6

Owen & Sons Computer Centre ETI/CN 2101 Government St., Victoria, B.C., V8T 4P2 (604)383-7134

Vancouver Island's only authorized Commodore Computer systems dealer. Full inventory of soft-ware, hardware, and accessories. Servicing of all products done on-site. Nanaimo & Victoria.

Radio Shack 3170 Tillicum Rd., Unit 125 Tillicum Mall, Victoria, B.C., V9A 6T2 (604)382-2024 Radio Shack TRS-80 Models II, III, 16 and colour computers. Hardware and software, plus related

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Radio Shack Computer Centre 707 Johnson St., Victoria, B.C., V8W 1M8 MO CAT FREE

Micro computer sales & support. Computer educa-tion. TRS-80 models IV, IV portable, model 12, model 16, multi-user (Xenix). Colour computer for home, printers, Tandy 2000 MS-DOS.

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Vector Graphic, Apple //e, Epson QX-10, Epson Printers, Olivetti, and Corona computers. Software: BPI, Beagle Bros., Systems Plus, Broderbund, Peripherals: TG, joysticks, Datalife disket-

Software Express Canada P.O. Box 5007, Station B, Victoria, B.C., V8R 6N3 (604)382-4311 MO CAT FREE

National microcomputer mail order company of-fering a selection of software and peripheral pro-ducts for most micro systems.

Tecworld Computers CN 1551 Cedar Hill Road, Victoria, B.C., V8P 2P3 (604)721-1544

Victoria Personal Computers Ltd. 1010 Blanshard St., Victoria, B.C., V8W 2H5 (604)388-6212 Apple, Wang, Kaypro, Corona, sales, rentals, service, education division.

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Ace Tech. Computer & Video 18-3012 17th Ave. S.E., Calgary, Alta., T2A 0P9

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Complete electronic components and computer products needs. Texas Instruments, Motorola,

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Alpha Micro Computer 1504-14th St. S.W., Calgary, Alta., T3V 3C3

Altel Data 6204-3rd St. S.E., Calgary, Alta., T2H 1K4 (403)259-7000 CAT FREE

Leaders in computers and data communications in Alberta. Major supplier of computers (micros & minis), peripherals, data sets, multiplexers, CRTs, printers and network services.

Allwest Computer Systems Inc. #7, 1305-33rd St. N.E., Calgary, Alta., T2A 5P1 (403)230-4272

Sperry, Televideo, Okidata, Qume, Targa, Corona, Champion, KIS, Supercalc, Wordstar, Agri-Software, Allwest Accounting Software, Salvo.

Cardinal Industrial Electronics ETI/CN Bay 10-5920 11th St. S.E., Calgary, Alta., T2H 2M4

Computer Centre 4908-17th Ave., S.E., Calgary, Alta., T2A 0V4 (413)272-9874

Franklin computers AMS general ledger system, wholesale/retail; specializing in business applications.

Computer Innovations 200 8th Ave. S.W., Calgary, Alta., T2P 1B5 (403)294-1224 IBM PC and XT, DEC Professional, Lisa, Apple //e and ///.

Computer Innovations 103-723-14th St. N.W., Calgary, Alta., T2N 2A4

Computer Innovations 920-36th St. N.E., Suite 142, Calgary, Alta., T2A 6L8 (403)235-4541 Lisa, Apple //e and ///, DEC Professional, IBM PC

Computer Innovations 100 Anderson Rd. S.E., Calgary, Alta, T2J 3V1

Computer Innovations 111-5809 McLeod Trail St., Calgary, Alta., T2H 0J9

Computer Mart 26-1410 40th Ave. N.E., Calgary, Alta., T2E 6L1

Computerland \_ 1212 First St. S.E., Suite 112, Calgary, Alta., T2G 2H8 (403)237-6423

Computerland 10333 South Port Rd. S.W., Calgary, Alta., T2W 3X6

Computer Solutions 1700 Varsity Estates Drive N.E., Calgary, Alta., T3B 2W9 (403)286-8459 Authorized CROMEMCO dealer serving Western Canada. Highly support oriented. Custom software. Both Z-80 and 6800 single and multi-user systems. Variety of peripherals and support pro-

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Data Terminal Mart 301-14th St. N.W., Calgary, Alta., T2N 2A1

ducts.

Eaton's Business Centre 408-8th Ave. S.W., Calgary, Alta., T2P 2L9 (403)266-0234

Computers from IBM, Apple, and Zenith. One of the widest selections of business, educational, and entertainment software. Training courses, leasing and financing are all available.

Epson Canada Ltd. 12-6125 12th St. S.E., Calgary, Alta., T2H 2K1

Heathkit Electronic & Computer Centre ETI/CN 101-5809 Macleod Trail S., Calgary, Alta., T2H 0J9 (403)252-2688 MO CAT FREE

Complete line of Heathkit and Zenith Data Systems computer products as well as Zenith monitors, Epson printers, Hayes modems. Software by Digital Research, Microsoft, Peachtree and others.

Hindson Computer Systems Ltd. 7144 Fisher St. S.E., Calgary, Alta., T2H 0W5 (403)252-9576 Commodore computers, peripherals, software. Epson, Gemini, Brother, Smith Corona printers. MS-DOS systems.

IBM Product Centre
Bow Valley Square II, 117-205 5th St. S.W.,
Calgary, Alta, T2P 2V7

Kellam Business Systems #100, 720-28th St. N.E., Calgary, Alta., T2A 6R3 (403)273-2733 Hewlett-Packard 150 Series touch screen computer. Hewlett-Packard printers, plotters, business software. Commodore 8000 series business computers, peripherals and software.

MAI Canada Ltd. 19-6025 12th St. S.E., Calgary, Alta., T2H 2K1

Norango Computer Systems 3016 19th St. N.E., Suite 101, Calgary, Alta., T2E 6Y9 (403)250-1222 Specializing in multi-user business systems, com-

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#### CODING KEY

ETI ETI Magazine sold here CN CN! Magazine sold here EC **Supplies Electronic** Components RTV Sells Radio and TV parts TG Sells Test Gear FK **Sells Electronic Kits** MO Company does Mail Order CAT Catalogue available.

The cost of this, or if it is free, is shown.



Figure 3. One system that is rapidly rising in the popularity charts is the Acorn Electron, a less expensive version of the BBC microcomputer. It runs most of the BBC software and costs two-thirds of the price, about \$350.

#### No Modems, No Boards

Telecommunications has become exceedingly popular in Britain recently. Although bulletin boards are practically unknown, possibly because the British pay for every phone call on a timed basis, the British *Prestel*. . . as expounded upon to the June 1983 edition of Computing Now!... has had a big boost since a commercial company started distributing software over it.

Prestel is accessed over the regular phone lines but you also pay for the access time, being billed along with with your phone enabling the information supplier to make money.

The use of computers in business is certainly no more advanced than it is here. I came across a number of comments that may not be typical but were surprising. For example, it was felt that microcomputers had few applications in business other for accounting for small companies.

The British seem badly informed about what is happening here, in the same way as

we know little of developments over there. Everyone I spoke to assumed that things in North America were the same as there but even bigger. They were surprised to learn that in home computing at least, they are far more advanced.

The reasons for the success of the home computer in Britain and its development can be ascribed to two factors. Firstly, the Sinclair machines have made low end systems very affordable. Secondly, much can be attributed to a television series put out about two years ago by the BBC in prime time. The BBC, however, did far more than put out a program. They set the specifications for a computer to accompany the series and gave the contract to Acorn... much to the annoyance of Sir Clive Sinclair who is supposed to have launched the Spectrum as a consequence.

The BBC micro is an excellent computer, but it is not cheap. It's now available in Canada but is intended primarily for the educational market. The BBC TV program

on microcomputing has been shown on some PBS stations in the US which can be seen north of the border... it's not bad, but a poor second cousin to TV Ontario's *Bits and Bytes*.

Another big boost given to computing was the British government's extensive program to put a computer in every school before December 1982. This target was achieved and the dominant system in that field has turned out to be the BBC micro.

#### Paper

The British are not short of computer oriented reading. There are at least seventy microcomputing magazines specialized for almost every conceivable area of the field. The "mens" magazines... the ones they airbrush half to death over here... that used to take up the top shelves have been replaced by computer titles. Not one was imported.

Not everything is rosy in Britain. There have been casualties. The *Dragon* computer... half heartedly launched in Canada about a year ago... has been slain and a number of other companies have gone the same way. There is also a shakeout going on in the software field where in even some major companies have vanished.

There has never, in the recent past anyway, been a fad that has not swept from one Western country to another. Most of these originate in the US and Southern California in particular. In this case, the home computer has really got under way in Britain, largely due to a television show and two computers almost unknown here.

It should be noted that interest in computers in the rest of Europe is not only far behind that of Britain but of North America as well.

Texas Instruments, fathers of the lamented TI-99/4A and Timex with the TS1000 have both pulled out from the low end of the market... only the Commodore systems have prospered. This presumably has made other companies nervous of this market. However, if the British computer industry is a suitable model for our own, it seems only a question of time before some company introduces a system that will capture the imagination of home computer users.

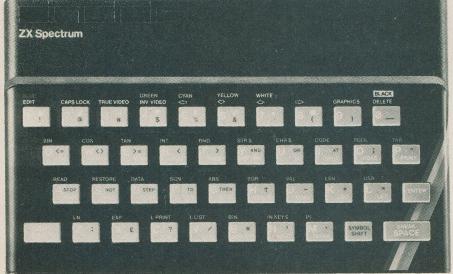


Figure 4. One of the two computers that brought about the computer revolution in Britain, the Sinclair Spectrum. A 48K system costs \$225. A North American version was in the process of being launched when Timex, who handled Sinclair products here, withdrew from the market.

# **New Shoes for Your 64**

The Commodore 64 is a powerful little beast... but it is a bit short on specialized keywords in its BASIC. With a bit of code and some understanding of how BASIC manipulates its data you can add a few new ones.

adapted from an article by A. L. Cross

uite a long time ago the BASIC in the Commodore 64, historically referred to as *PET BASIC*, was regarded as being among the most sophisticated of languages. This, however, was back in pre-historic times when many people still thought of paper tape as the ultimate mass storage medium for microcomputers.

Things have changed and the level of development of BASIC has ascended momentously. New statements have been added to manipulate data, make I/O simpler and do all manner of sophisticated stuff. Once largely regarded as being a beginner's language, Microsoft BASIC is now routinely employed to write sophisticated applications. This has not, however, done much for the Commodore owner.

The BASIC in the Commodore 64 has not changed appreciably from that of the PET 2001, some six years more decrepit. Once proud and really quite neat it has acquired a patina of antiquity. A few new commands wouldn't hurt it at all.

In this feature we're going to look at ways of adding things to BASIC. When all the dust has settled and the LDA's and STA's are where they should be again we'll have a Commodore BASIC which supports a number of new keywords that Commodore never really planned on.

#### String Things

Strings are stored in ways that are rather different from those of numbers. There's a perfectly good reason for this... strings can get quite large, and the efficient manipulation of them requires that they be handled a bit specially.

One toodles about with numbers by physically moving their data about the computer. This is fine for five byte numerical data... but tedious for two hundred and fifty—five byte strings.

For this reason, a string is stored in memory somewhere and largely left there unless its contents are changed. The computer keeps track of it using a header, or descriptor, in a table of string pointers. As such, when we reference a string we are really referencing an entry in a table rather than the contents of the string itself.

The header consists of three bytes, to wit, a length byte and a sixteen bit address which points to the first byte of the string itself.

If we write a program which contains the line

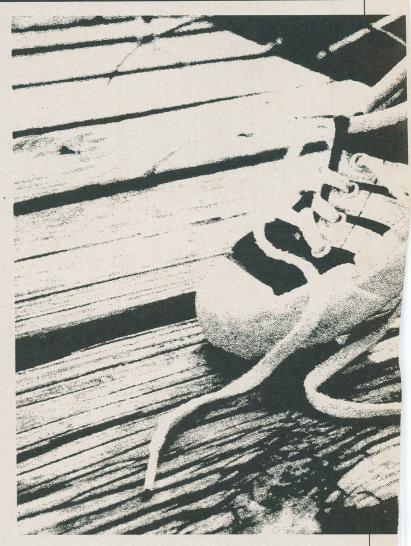
#### 10 A\$ = "ROCK AND ROLL"

an entry in the header table will be set up for A\$ pointing into the program itself. There is, after all, no point in storing the string up in high memory when it's already handy in the text.

If we then added

#### 20 B\$ = A\$ + "WILL NEVER DIE"

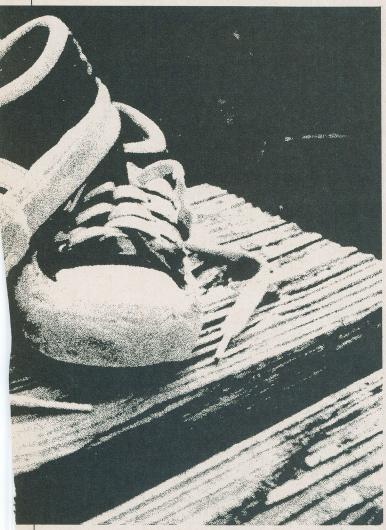
the contents of the string A\$ and the literal in line twenty would



be moved up into high memory and a pointer established in the header table for B\$.

As our program starts piling strings into memory the string storage space works its way downward from a point in high memory, usually \$9FFF. The bottom of this space is referred to as FRETOP. As you add more string data to the memory, FRETOP gets lower.

20 0330	
30 033C 40 033C	!# INSTRING KEYWORD #
50 033C 60 033C	!# VERSION 1.0 13/01/84 #
70 033C 80 033C	!# !# COPYRIGHT (C) A.L.CROSS 1984 #
90 033C	!
110 033C 120 033C	
130 C4B8 140 C4B8	*=\$C4B8
150 C4B8 160 C4B8	VARIABLES AND EQUATES
170 C4B8 180 C4B8	TSTOPB = \$AEFA
190 C4B8	TSTCLB = \$AEF7
200 C4B8 210 C4B8	TSTCOM = \$AEFD GETSTG = \$B6A3
220 C4B8 230 C4B8	CVTFPN = \$B391 CHKSTK = \$A3FB
240 C4B8 250 C4B8	EXPR = \$AD9E ADDS1 = \$FB



260 C4B8 270 C4B8 280 C4B8 290 C4B8 00	Annse	=	\$22	
270 C488	I FN1	-	\$FD	
280 C488	LEND	_	*EE	
200 C480 00	COLINIT	DUT	*00	
300 C4B9	COUNT	DTI	*00	
310 C4B9				
220 0400 5055	THETE	00	#\$FF INSTOK	LOUES FUNCTION FLOO
320 C489 EOFF	THEIR	CPX	帯争とと	!CHECK FUNCTION FLAG
330 C4BB F003		BEO	INSTOR	
320 C4B9 E0FF 330 C4BB F003 340 C4BD 4C06AF 350 C4C0 A901	********	JMP	\$HF 08	
350 C4C0 H901	INSTUK	LDH	#\$61	!CHECK STACK SPACE
360 C4C2 20FBH3		JSR	CHKSTK	
370 C4C5 20FHHE		JSR	TSTOPB	!CHECK BRACKET
380 C4C8 209EHD		JSR	EXPR	!GET STRING1\$
390 C4CB 20A3B6		JSR	GETSTG	
400 C4CE 85FD		STA	LEN1	ISAVE LENGTH BYTE
410 C4D0 A533		LDA	\$33	
420 C4D2 48		PHA		ISAVE CURRENT END OF
430 C4D3 A534		LDA	\$34	
440 C4D5 48		PHA		ISTRING SPACE POINTER
450 C4D6 86FB		STX	ADDS1	ISAVE LOW ADDS BYTE
460 C4D8 8633		STX	\$33	!UPDATE END OF
470 C4DA 84FC		STY	ADDS1+1	ISAVE HIGH ADDS BYTE
480 C4DC 8434		STY	\$34	ISTRING SPACE POINTER
490 CADE 20FDAE		ISR	TSTCOM	TOHECK COMMA
500 C4F1 209F6D		ISP	EXPR	IGET STRING2#
510 C4E4 2003B6		TOP	GETSIG	321
520 C4EZ 85EE		STA	LENS	ISAVE LENGTH RVTE
530 0469 68		FIR	CLITE	I PESTOPE OF THE END OF
549 C4ER 2534		STO	*24	THEOTORE OLD LIND OF
550 CAEC 60		010	407	TOTOTHIC COOCE DOTHITED
SEG CAED OFFICE		CTO	#22	STRING SPHEE POINTER
E20 CAED 00530		700	TOTOL T	LOUECK PROCKET
BOO CAES OFFE		JOR	TSICLE	THEUR BRHUNE!
DON CAPE HOFT		LDH	LENI	(GET LEN(STRINGT#)
300 C4F4 38		SEL		
BUB LAFT EDFE		SBU	LEN2	(SUB, LENCSTRING2#)
PID (4F) 305F		BUU	NULTH	TH STRINGZEDSTRINGIE
620 (4F9 8DB804		SIH	COUNT	
530 LAFL EEB8C4		THE	COUNT	ICHECK STACK SPACE ICHECK BRACKET IGET STRING18 ISAVE LENGTH BYTE ISAVE CURRENT END OF ISTRING SPACE POINTER ISAVE LOW ADDS BYTE IUPDATE END OF ISTRING SPACE POINTER ICHECK COMMA IGET STRING28 ISAVE LENGTH BYTE ICHECK COMMA IGET STRING28 ISAVE LENGTH BYTE ICHECK BRACKET ICHEC
640 C4FF R201	-1	LDX	##61	INIT POSITION COUNT
650 C501 H000	UUTRLE	LD'Y	#10	INTE POSITION INDEX
660 C503 B1FB	MAINLE	LDA	(ADDS1),Y	!STRING1≢ CHAR
670 0505 D122		CMP	(ADDS2),Y	!EQUAL TO STRING2#
ESM CSMZ TIMMS		RNE	NOTEDI	

690 0509			INY		INEXT CHARACTER	
700 C506				LEN2	TEND OF STRING2#2	
710 C500				STGFND	CIND OF STRINGES:	
720 C50E			SEC			
730 C50F				MAINLP	PREPERT	
749 0511			INX		INC POSITION COUNT	
750 (512				COUNT	DEC CHARACTER COUNT	
769 C515				HOTIN	IF AT END OF STRING1#	
770 C517				ADDS1	!INC STRING1# ADDS	
				OUTRLP	POINTER	
790 0511						
800 0511	38		SEC			
810 0516	BOE 1		BCS	OUTRLE		
820 0526	9 8A	STGEND	TXB		IGET CHARACTER POS	
830 C52:	A8		TAY		LINTO AZY PAIR	
840 0523	9900 H	RTHEND	LDA	#\$0		
850 0524	4091B3		JMP	CVTFPN	ICONVERT TO FPN	
869 052				#\$0	ISET AZY TO ZERO	
870 C529			SEC			
280 (52)	ROFE		RES	PTHEND		

Listing 1. The INSTR keyword.

#### Stack

In order to manipulate strings effectively, the 64 maintains something called the *temporary string stack*. This is an area of memory where the system can stash string pointers when it is working on complex strings. For example, to arrive at the result of

```
10 A$ = 'ELECTRIC'
20 B$ = 'WOMBATS'
30 C$ = 'RULE THE SKIES'
40 PRINT MID$(A$ + B$ + LEFT$(C$.4).3.6)
```

A\$ and B\$ must be concatenated and the resulting header saved on the temporary stack. Then LEFT\$(C\$,4) must be, likewise, created and its descriptor pushed on the stack. Finally, the stack contents can be popped off the stack and used to evaluate the full string.

The string A\$ + B\$, while it exists during the evaluation of this expression, is called a *temporary string*. Once the evaluation is complete it is of no further use. As such, the FRETOP pointer can be moved to to exclude it from the string space. This allows new data to be written over it as required by the system.

The temporary string stack on the Commodore 64 can hold three headers. It runs from \$0019 to \$0021. Trying to evaluate a string which requires the system to juggle more than three strings will cause BASIC to through a FORMULA TOO COMPLEX error

The Commodore 64's BASIC has a routine called EXPR which evaluates expressions. Its entry point is \$AD9E. It expects to find a pointer in TXTPTR and leaves a descriptor of the string in the first floating point accumulator, \$61 for the length and a pointer to the string text in \$62 and \$63.

When EXPR is finished doing its thing we have a largely evaluated expression. However, we still have to ascertain whether it was, in fact, dealing with strings and whether the string involved is temporary, in which case we'll want to move FRETOP back up after all the dust settles.

This is handled by GETSTG, at \$B6A3. If it doesn't find a string where it expects one it will throw a TYPE MISMATCH error. Upon return from GETSTG, the X and Y registers will contain a pointer to the string descriptor, as will locations \$22 and \$23. If the string is, in fact, temporary this routine will adjust FRETOP accordingly.

At this point, the string is unprotected by FRETOP... other data can overwrite it. However, all of the descriptor data is still valid and, as such, we can still work with the string.

#### Some Tricks

Having some understanding of the wiles of string handling, we're now going to look at the machinations involved in adding three

# **New Shoes for the Commodore 64**

new keywords to BASIC.

The first new word, INSTR, is of the form

#### N = INSTR(A\$,B\$)

It will scan through A\$ looking for B\$... which should, for any sort of useful result, be shorter than A\$. If it doesn't find B\$ it will return a zero in N. Otherwise it will return the position of B\$ in A\$.

The code for INSTR is offered in listing one.

The operation of INSTR is fairly easy to trace. The *string1\$* parameter is extracted by calling EXPR and GETSTG. The length and address bytes are saved in locations LEN1 and ADDS1.

If the first string happened to be temporary it would be overwritten by another call to EXPR... which is coming down the line, as we'll have to evaluate the second string in a moment. Thus, the string address for string one... it still lives in the X and Y registers, as you'll recall... is loaded into FRETOP, reprotecting the first string.

A second call to EXPR and to GETSTG gives us the second string. The length of this string is saved in LEN2. Having manipulated FRETOP previously, GETSTG will have moved it slightly erroneously, leaving it printing to the bottom of the first string. If we restore its original value the string area will be clear.

The actual mechanism of comparing the two strings is pretty straightforward, simply requiring that one compare the second string to all the possible positions of the first. If a match is found the X register is loaded into the first floating point accumulator by copying X into Y, loading A with 0 and calling CVTFPN. If a match is not found the floating point accumulator will contain zero.

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STGPTR
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                                                                                                                                                                                                                                                               JSR GETBYT
TXM
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COPYLP
($22),Y
($62),Y
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         ISET STRING POINTERS
```

Listing 2. The MULT\$ keyword.

#### **Unbroken Chain**

The MULT\$ keyword is similar to INSTR in operation, but it returns a string. The expression

#### A\$ = MULT\$(100,"!")

will return with A\$ holding a string of a hundred exclamation points. It's important to note that MULT\$ will only operate on the first character of its string expression, so MULTI\$(6, "GNU") would return GGGGGG.

The two parameters of the MULT\$ expression are extracted in much the same way as we saw happen with INSTR. The first of these is, of course, evaluated as a numeric value rather than as a string. It provides the length byte for the new string which will be created as a result of calling MULTI\$.



Listing 3. The SWAP command.

The new string is assembled in memory by writing the character passed to MULTI\$ as its string parameter... pointed to by location \$22... as many times as the length byte calls for. If the numeric parameter happened to be zero the routine would write nulls, to assure that a null string was returned.

All of this in place, a descriptor for the new string can be created in the first floating point accumulator and on the temporary stack.

The gory details of MULT\$ are given in listing two.

Finally, we're going to do a really easy one called SWAP. It's often the case that you will want to interchange the contents of two variables. You can do this in the traditional old and funky style... to exchange A\$ and B\$ you would

#### C\$ = A\$ : A\$ = B\$ : B\$ = C\$

This is slow, awkward and uses up memory you may have had other plans for.

The swap command, of the form

#### SWAP AS,B\$

is much slicker. It does all the changes by manipulating those variable headers, or descriptors, we've been going on about.

If you consider this problem for a moment, swapping two variables is actually very simple. You would simply locate the variables in question in the table of headers and interchange their

SWAP works with any kind of variable... numeric as well as strings... but, for obvious reasons both parameters must be of the

The operation of SWAP will be easily traced through the listing if you feel up for it.

#### The Key

Adding new commands and functions to your 64 isn't really that difficult... and it allows one to customize BASIC for one's particular needs. In this light you could look at the sparse BASIC of the 64 as an asset. The system doesn't waste valuable memory with unnecessary commands, but, rather allows one to add only those that are required.

Yes, that sounds a bit flaky to me, too.

If you look at these listings you should be able to create some additional keywords of your own.

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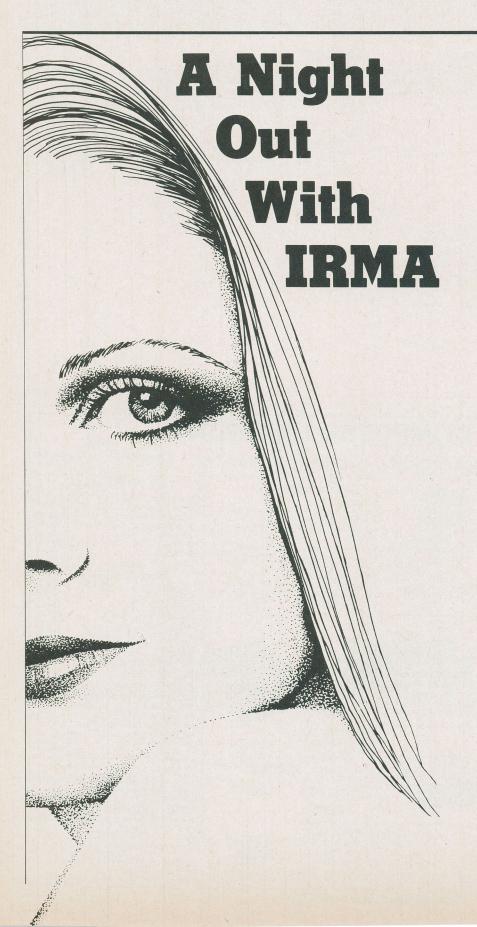
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In sophisticated business environments the decision between micros and mainframes often becomes quite the juggling act. With a bit more technology, however, one can keep all the balls in the air.

#### by Frank Lenk

he IBM PC represented quite a breakthrough for the business community. At last there was something that looked like it should be friendly with a mainframe in a desktop sized box. However, like all new technology the furor of interest subsided after a while and people actually started to try to find uses for the big blues.

In fact, the advent of personal business computers has not made everyone entirely happy. Users accustomed to funnelling things through a central mainframe and its outlying peripherals often find themselves in a schizoid frame of mind. Part of what they do works best on their desktop PC. Another part can only be done on line to the common data pool and processing power of the mainframe. Yet another lot of work could benefit from an intimate conjunction of the two... work that could be processed offline and yet channelled through the mainframe at the appropriate times.

#### The Link

The idea of mainframe to micro communications, especially for the purposes of the businessman, is still relatively unexplored. This is somewhat surprising, given the coverage it has received in the trade publications. Certainly for the experienced computer user... read "hacker"... the advantages of linking the two types of computers are obvious and seemingly easy to implement. If one simply made a list of tasks the two different types of computers perform well... as I did to help me write this article... and then imagined a system that would perform all those tasks well, one would probable have conceived of a near ideal computer system.

In fact, a quick glance at such a list might be surprising... the two types of computers have little in common, especially from the point of view of the business user. Perhaps the mainframe's most important task is the storage of large, centralized databases. I de-emphasize speed because even the most powerful computers seem slow when too many people are using them, as is invariably the case.

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## A Night Out With IRMA

Of course, storing a large database on a microcomputer, even in a network, is often impractical. Distributing copies of the database usually won't work either, since there would be a lack of centralized control of data integrity. However, the micro has word processing and spreadsheet software, of a quality and sophistication which probably can't be had on a mainframe at any price.

Ideally, one could selectively extract pieces of the central database, put them on a floppy and load them into the word processor or spreadsheet... where they could be manipulated locally on a micro. The flexibility of microcomputer software compares very favourably with the process of defining a request for the systems people... them what writes software for the mainframe systems... convincing them that they can give you what you want, and then waiting for them to reinvent the wheel for you in COBOL.

I'm sure that most businessmen would dearly love to make systems people redundant, and a powerful mainframe micro link can go a long way toward doing that. While eliminating jobs is not necessarily a good thing, there surely can't be many people who actually like programming in COBOL.

Of course, the advantages of the micro to mainframe link don't end with simple transfer of information. Text and data can be prepared using a high quality piece of software, without the response time problems or the on line cost, and uploaded to the mainframe database. Given the price of mainframe business software ...what little there is is generally ten to twenty times as expensive as equivalent or superior micro software... and the cost of just being connected to a mainframe, significant savings can be realized in terms of both money and time.

Computer mail is another idea that gets bounced around the business computer world, usually in regards to micro computer networks. However, if everyone has a mainframe account anyway, this function can be promises. These compromises, in case you were wondering, are usually a poor keyboard, a poor screen, a possibly slower data transfer rate and a couple of extra steps that are generally required to make the connection.

There are literally dozens of products available that will allow an IBM PC to emulate a wide variety of terminal types. I recently found sixteen emulators for IBM 3270 type terminals alone. Of these, one of the first, and still one the most popular, is the IRMA board by DCA.

#### Irma Is a Lady

The letters I R M A don't stand for anything at all, except that they're the name of both the plug-in PC board and of a mysterious female whose bare shoulder graces the advertising and the cover of the manual for this hardware. IRMA the PC board is an average looking interface card. It originates with DCA ...formerly TAC, the Technical Analysis Corporation... in Atlanta, Georgia. On the Toronto shelf ...I checked Computerland... it sells for something under two

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handled by the mainframe. Thus, one of the main pseudo-advantages of expensive micro computer LANs is eliminated if a mainframe terminal network already exists.

Another obvious advantage of linking these two computer spheres is the elimination of an expensive piece of hardware, the terminal. Although the more common personal computers don't make very luxurious terminals, the savings in money, power, and desk space will likely make up for the com-

thousand dollars, a price tag that includes the board as well as two disks of software.

In actual fact, most of the local computer outlets don't keep a vast supply of IR-MA boards in stock, but will order them to fulfill any demand that arises. IRMA doesn't sell like video games do.

What IRMA ...the board... does is emulate the standard IBM 3270 smart terminal. This is a reasonable achievement, since the best that most terminal software.

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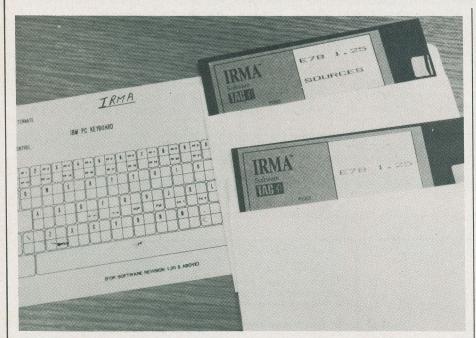
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The next step down from a board like IRMA would probably be something like the SDLC bisynchronous communications adapter card for about four hundred and fifty dollars, which requires 3270 emulation software for about eight seventy-five. Though cheaper, the basic bisynchronous card doesn't really give the performance of a smart emulator.

Another option might be the Tempus Link, from Logic Quest in Montreal. For a mere five grand this setup hooks five users to a mainframe by allowing the micros to treat the mainframe as a hard disk. An appropriate program intercepts incoming data at the mainframe end and routes it appropriately. Again, this is not quite as slick as actual terminal emulation.

I eventually found some folks that are actually using IRMA boards to converse with their pet mainframe. Du Pont is one company that jumped on IRMA with both feet, so to speak. It now has fourteen or so IRMA equipped PC's in operation, chatting with two mainframe machines.

Du Pont also operates a couple of PDP 11's, but finds that Crosstalk is adequate for talking to those.

#### Taking IRMA Home

IRMA comes with one of those hefty ring bound manuals that seem to accompany all PC software. Most of this paper is really devoted to the use of the software utilities, since the IRMA board itself will offer few surprises to those familiar with the 3270 ter-

One trick with IRMA, however, is the allocation of keycodes. Since the 3270 has a plethora of special keys not found on the standard IBM PC keyboard, the SHIFT, ALT and CTRL keys must all be used to provide the complete set of controls. IRMA does offer the capability of redefining the keys, to allow its use on various IBM clones, or for special applications like programming in APL. Another thing to be noted is that IR-MA is actually 3279 compatible, which means that it supports colour.

Of the two IRMA disks, one is merely source code for the other. The main disk provides editing and uploading of PC files. To boot it, first the E78 terminal emulator is run, and then the FT 78T file transfer program. However, it seems that the mainframe must be accessed as a straight TSO environment or the system hiccups. SPF, for example, apparently won't run with the IRMA file transfer.

To the PC user things will look pretty straightforward. The IRMA utilities run under standard PC DOS. The user has the freedom of switching back and forth between TSO and PC DOS without losing any

While it all sounds pretty simple, you might well wonder how this works out in practice? According to Du Pont, a 3278 terminal can be had for only about a hundred and forty dollars a month. This makes it the most economical way to talk to a mainframe, at least for an operation on the Du Pont scale. Where IRMA comes into her own is for the more demanding user, who will theoretically be doing considerable manipulation of the data. This can be done

offline on the PC, then uploaded.

At present, Du Pont is still developing applications for IRMA. Eventually, much of her work will involve offline data entry for the ANSWER database being used on the mainframe.

#### **Furthermore**

At present, IRMA looks like the favorite for the PC user who wants to hit the mainframe big time. Of course, the occasional remote system log on is still best left to asynchronous software, such as Crosstalk, which will let you do a lot of the same things as IR-MA but for a lot less money... about two hundred and sixty dollars. However, if you feel the need to be online a fair amount, IR-MA's your airl.

For now, that is. Word is that DCA already has a new board on the way, dubbed P-COX. The mind boggles.

DSA (Digital Communications Associates, Inc.) is located at 303 Technology Park, Norcross, Georgia 30092 in the United States. IRMA's phone number is (404) 448-1400.

# Software Now! First Issue October 1984



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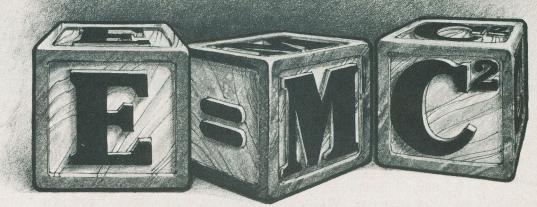
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## Celestial Mechanic

Your PC can send you out into the limitless void to look back upon the solar system... all without the use of a joystick or a fire button. All you need is this simple BASIC program.

by Steve Rimmer

F



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## **Celestial Mechanic**

It's a widely accepted fact that the relative postion of the planets in the heavens has a great effect on our daily lives. If Mars is in the appropriate quadrant of the sky one can expect to have a vital, effective day. The alignment of Venus and Mercury will determine the temperment of people having large feet. If three or more planets are in conjunction then one can be sure of one's car starting reliably even if if there are more than ten thousand miles on the plugs.

Yes, fortunately, it's a widely accepted fact widely accepted

largely by loonies.

The positioning of the planets does actually affect some things... most of them having to do with assorted spacecraft we'll never see again. For the most part, however, the planets are just brighter lights in the night sky and places for the spirits of members of obscure cults to go to during trances.

Seen from way out in space, the solar system probably looks pretty slick... all those planets wheeling around the sun and all. Of course, they don't wheel all that quickly... it helps to have a

geological sense of time.

The Celestial Mechanic is a program for humans who can't afford the gas to go out and see the solar system and don't want to wait around for two hundred and eighty-four years just to watch Pluto complete an orbit. It's a reasonably authentic model of our local rocks which runs on an IBM PC. Under its auspices, one can check out the floating real estate without once leaving the comfort of one's own air lock.

Seeing Stars

The Mechanic is a fairly short program... it could have been a lot shorter, but these things tend to get out of hand quite easily. When run it will plot the sun and nine planets on the tube. The system's speaker will begin to emit the music of the spheres... random beeps and bops of an outer space sound track... and the planets will set about on eliptic orbits. This is a somewhat sidewise view... the more or less circular orbits we're all familar with will look eliptical.

In order to make the planets appear to be traveling along recognizable paths, their orbits will be plotted by the occasional

pixel as they go.

The music of the spheres gets pretty annoying after a while, and, as such, can be toggled off by hitting the fl key. Whenever the music is supposed to be playing a musical note symbol will

appear in the lower right hand corner of the tube.

The whole works is fairly alactritous... Mercury does an orbit in well under a minute. Pluto, on the other hand, takes about an hour. Note that while the spatial scale of the Mechanic is all wrong... all the planets are the same distance apart... the time scale is accurate. It would have been largely impossible to have done the thing physically to scale... one would have needed one IBM in the centre of the room to display the sun and a second across the building for the outer planets. No mechanism for orbiting one IBM around another without tangling their power cords could be immediately found and, as such, the project was abandoned.

#### The Works

The program is fairly simple to understand. The heart of it is in the subroutine at line 390, which spews out the points along the eliptical orbits. It differentiates between the nine elipses by storing the current one in the array T.

Since one can't plot points like this using the IBM's CIRCLE command... it isn't nearly accurate enough... this routine has to create a circle in the old tedious way, using SIN and COS. This, admittedly, slows things up a bit.

The work involved in typing in the Mechanic probably belies its complexity... the freaky math involved in making all this happen properly took considerable doing.

While not so useful as SuperCalc nor so large as Symphony, the Celestial Mechanic will give your computer something to do while you're away. It will help you to grasp the splendor of the cosmos in which we live, the colossal grandure of the heavens and, more to the point, take your mind off the payments still left on your system.

I wonder if the mortgage on the Earth has been settled yet.

```
100 '****************
110 '*
120 '*
            celestial mechanic
130 '*
             for the ibm pc
140 '*
            copyright (c) 1984
150 '*
               steve rimmer
160 '*
170 ********************
180 '
190 '
200 KEY OFF: SCREEN 2: CLS
210 \text{ SND} = 1
220 LINE (0,5) - (640,17),7,B : LOCATE
     23,78,0 : PRINT CHR$(14)
230 LOCATE 2,11,0 : PRINT "Celestial
     Mechanic
               copyright (C) 1984
     Steve Rimmer"
240 LINE (0,173)-(640,185),7,B
250 CIRCLE (250,100),14,7
260 DIM MONTH$(11), DAYS(11)
270 FOR X=0 TO 11 : READ
     MONTH$(X), DAYS(X) : NEXT X
280 P=1 : D=3
                : S= .24
                            : GOSUB 390
290 P=2 : D=4.5 : S= .62
                            : GOSUB 390
300 P=3 : D=6 : S= 1
                           : GOSUB 390
310 P=4 : D=7.5 : S= 1.88 : GOSUB 390
320 P=5 : D=9 : S= 11.86 : GOSUB 390
330 P=6 : D=10.5 : S= 29.46 : GOSUB 390
340 P=7 : D=12 : S= 84.01 : GOSUB 390
350 P=8 : D=13.5 : S= 164.97: GOSUB 390
360 P=9 : D=15 : S= 248.4 : GOSUB 390
370 GOTO 280
380 END
390 'PLOT AN ORBIT
400 KEY (1) ON: ON KEY (1) GOSUB 770
410 B=3*D : A=25*D
420 T(P) = T(P) + (.2/D) *
     (1/S)*(D*3.14159)/10
430 IF T(P) >= 6.28318 THEN T(P)=0: IF
     P=0 THEN M=0
440 X = A*COS(T(P)) : Y = B*SIN(T(P))
450 CIRCLE (J(P),K(P)),4,0
460 PSET (INT(J(P)), INT(K(P)))
```

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### **Celestial Mechanic**

- 470 J(P) = X+250 : K(P) = Y+100480 CIRCLE (J(P),K(P)),4,7 490 IF P=3 THEN GOSUB 550 500 RETURN 510 DATA "JANUARY", 31, "FEBRUARY", 28, "MARCH", 31, "APRIL", 30 520 DATA "MAY", 31, "JUNE", 30, "JULY", 31, "AUGUST",31 530 DATA "SEPTEMBER", 30, "OCTOBER", 31, "NOVEMBER", 30 540 DATA "DECEMBER", 31 550 'SAY WHAT MONTH IT IS 560 IF P<>3 THEN RETURN 570 C = C+1580 LOCATE 23,3,0 : PRINT MONTH\$(M) "." INT((DAYS(M)-8)\*(C/7))SPACE\$(50) 590 IF C>7 THEN C=0 : M =M+1 : IF M>11 THEN M=0 600 GOSUB 620 610 RETURN 620 'PLAY MUSIC OF THE SPHERES
- 630 IF SND =0 THEN RETURN 640 MUSIC\$ = "MSMB" 650 FOR Z=1 TO INT(RND(1)\*5) 660 GOSUB 700 : MUSIC\$ = MUSIC\$ + ARP\$ 670 NEXT Z 680 PLAY MUSIC\$ 690 RETURN 700 'CREATE ARPEGGIO 710 ARP = "T" +STR\$(INT(RND(1)\*55)+200)720 FOR Y=1 TO INT(RND(1)\*12) 730 ARP = ARP + "N" +STR\$(INT(RND(1)\*84)) 740 NEXT Y 750 IF INT(RND(1)\*3)=3 THEN ARP\$ = ARP\$ + "P" + STR\$(INT(RND(1)\*32)+32) 760 RETURN 770 'TOGGLE SOUND 780 IF SND = 0 THEN SND = 1 : LOCATE 23,78,0 : PRINT CHR\$(14) : RETURN 790 SND = 0 : LOCATE 23,78,0 : PRINT "

## personal

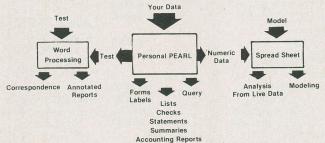
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" : RETURN

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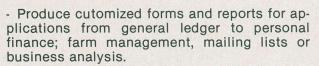
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470 J(P) = X+250 : K(P) = Y+100480 CIRCLE (J(P),K(P)),4,7 490 IF P=3 THEN GOSUB 550 500 RETURN 510 DATA "JANUARY", 31, "FEBRUARY", 28, "MARCH", 31, "APRIL", 30 520 DATA "MAY", 31, "JUNE", 30, "JULY", 31, "AUGUST",31 530 DATA "SEPTEMBER", 30, "OCTOBER", 31, "NOVEMBER", 30 540 DATA "DECEMBER", 31 550 'SAY WHAT MONTH IT IS 560 IF P<>3 THEN RETURN 570 C = C+1580 LOCATE 23.3.0 : PRINT MONTH\$(M) "," INT((DAYS(M)-8)\*(C/7)) SPACE\$(50) 590 IF C>7 THEN C=0 : M =M+1 : IF M>11 THEN M=0 600 GOSUB 620 610 RETURN 620 'PLAY MUSIC OF THE SPHERES

630 IF SND =0 THEN RETURN 640 MUSIC\$ = "MSMB" 650 FOR Z=1 TO INT(RND(1)\*5) 660 GOSUB 700 : MUSIC = MUSIC + ARP670 NEXT Z 680 PLAY MUSIC\$ 690 RETURN 700 'CREATE ARPEGGIO 710 ARP = "T" +STR\$(INT(RND(1)\*55)+200)720 FOR Y=1 TO INT(RND(1)\*12) 730 ARP = ARP + "N" +STR\$(INT(RND(1)\*84)) 740 NEXT Y 750 IF INT(RND(1)\*3)=3 THEN ARP\$ = ARP\$+ "P" + STR\$(INT(RND(1)\*32)+32) 760 RETURN 770 'TOGGLE SOUND 780 IF SND = 0 THEN SND = 1 : LOCATE 23,78,0 : PRINT CHR\$(14) : RETURN 790 SND = 0 : LOCATE 23,78,0 : PRINT " " : RETURN

## personal

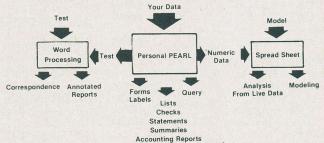


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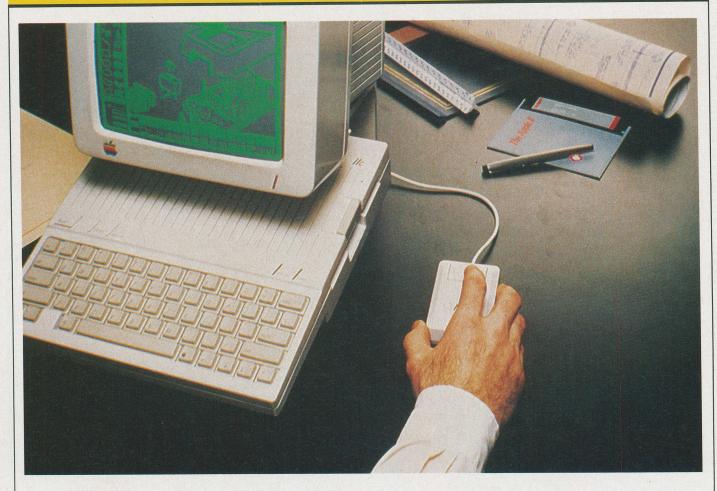
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## The Apple IIc Reviewed



A superb example of the early neo-Klingon pancake school of computer design, the Apple IIc is another contender for the low end mass market.

#### by Steve Rimmer

t wasn't late at all. In fact, it was about nine in the morning... a grossly inhuman hour to have to be awake during. The man standing at the door eating pickles and holding a cardboard box which had once contained Xerox paper looked vaguely familiar. Outside the door John was talking to Horatio the office cat.

"Hi," said the man. "It's here."

"Hot stuff." I said. "Could you set it up and stick that big ginger coloured one in it?"

The man looked around. "The big ginger coloured what?" he inquired. I knew his type. He was conscious... the swine.

"That monster gravy sucking cat out there. Stick im in and turn it up to ten."

"I don't think he'd fit." the fellow was sounding a bit confused.

"What kind of a cat compressor do you guys sell? I wanted to squeeze him into a singularity and pop him into hyperspace."

"Uh, it's not a cat compressor... it's a computer." the man said proudly.

"Damn microprocessors are getting into everything." I noted. "I distinctly ordered a cat compressor. We're already up to our clavicals in computers."

The man placed the box on the floor. There were various white plastic things in it. No doubt about it... what we had here had never been designed to compress cats. "This is the IIc you wanted for review."

I looked at the guy again. It was Ed from Apple's PR agency. Ed's a fairly normal looking guy, and before noon pretty well anyone normal looks about the same. One could generally tell when one was in

the midst of a visit from Apple's PR agency because their minions always came in pairs. The other half of the pair was always Bill. Bill has an unmistakable giant handlebar moustache, which Horatio always gets into playing with. Even when one was half asleep one could recognize Bill, and, as such, know what was going down.

"Where's Bill?" I asked.

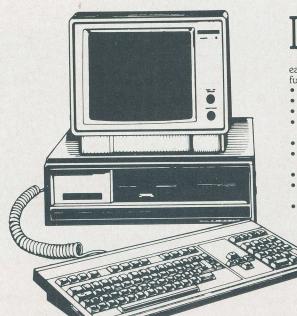
"He went to work for Apple itself a while back." replied Ed.

"Downer. It's like... Tonto without the Lone Ranger, y'know..."

Ed gave me a filthy look. I decided to change the subject.

"So, this is the Apple IIc. Do they all come in empty Xerox paper boxes?" This line of conversation didn't look like it was going to do any better.

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## The Apple IIc Reviewed

"I'm not coming here in the morning again." Ed said "You guys are weirder in the morning."

I started to unpack the Apple. It looked every bit as injection moulded as the ones on TV. I picked up a stack of manuals. I considered dropping them artistically, like they do with the IBM manuals on the Macintosh ads, but feared the wrath of Emiel, the caretaker, should I fracture his floor. "Heavy duty library." I noted. "Quite the massive read."

"Extremely well documented," corrected Ed.

I assembled the IIc on one of the tables we keep for such purposes. Ed turned to go.

"Hey, wait, the last time you brought a computer here for us to check out one of you guys stood by with a gun for two weeks to protect it." I said. "Aren't you even going to ask me to sign anything?"

"No," said Ed, heading for the door. "We've got millions of these things. Just stick a stamp on it when you're done and mail it back."

#### One by Land, II by c

The Apple IIc is, to begin with, essentially a very nicely put together Apple II+ clone sold by the one company that can never be persecuted for doing it. Under most circumstances, freaky new case and keyboard notwithstanding, the IIc will behave exactly like an Apple II+ or any other Apple compatible system. This means that most Apple II+ software will run on it, and that the various PEEKs, POKEs and CALLs one normally uses from Applesoft BASIC will largely all do the same stuff.

If the IIc were some manner of clone it would be an enhanced one. That is, while it will do what a II + is capable of, it is stuffed full of additional toys which make it somewhat more capable.

The "c" in the system's name is supposed to stand for "carryable". Don't worry if that's not actually a proper English word... the copyright on English ran out long ago, and Apple never kept up the royalty payments anyway. However, it sort of describes the computer.

Despite its having much of the capacity of a II+, the IIc is extremely small by traditional Apple standards. It's diminutive plastic case... about the size of a large coffee table book... contains a full sized QWERTY keyboard, a single five and a quarter inch disk drive and a motherboard with a hundred and twenty-eight K of memory and the functional equivalent of an eighty column card, a printer card and a serial card all hard wired in.

That keyboard has a somewhat freaky



feature, by the way, in that it can be switched between the normal keyboard, as represented by the keycaps, and one other... such as a foreign language character set... using a switch up top. The contents of the second set vary from country to country. North American IIc's feature the highly strange Dvorak keyboard layout as alternates.

There's a handle out back to lug the thing around by. However, as porting the IIc also involves carrying its fairly beefy power transformer... a separate box connected to it and the wall by long white cables just it itching to get tangled... and an assortment of disks and books, the computer comes with a shoulder bag designed to encompass all its paraphernalia.

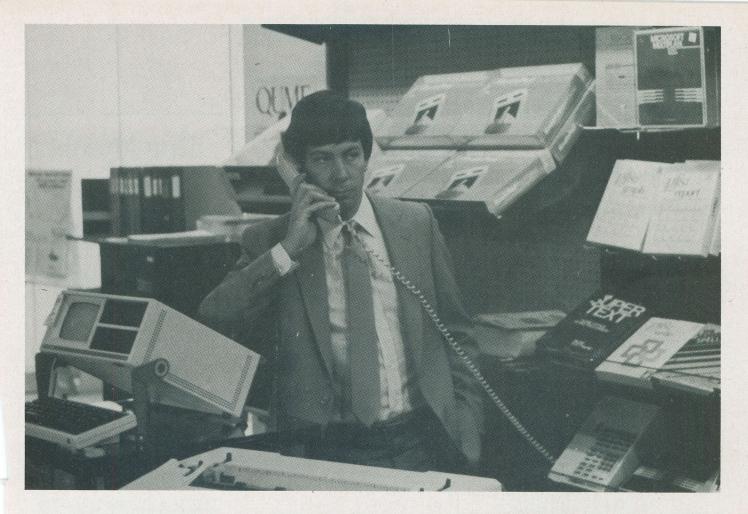
Well, okay, the bag doesn't actually inhale all of it. The thing also wants a tube. It will happily display its images on either a regular green screen monitor... either the slick high tech one shown in the ads or a sleazy slimy Zenith tube covered in stickies and graffiti... or a TV set through an accessory RF modulator. Consider one of these into the bargain and the system begins to look a lot less portable.

The idea behind all this is that every civilized place on the planet with useable electricity has a television set of some sort, so there's no need to lug a tube around. You simply take the computer from video to video, patching into them as you see fit.

It's an interesting concept but, if the "c" means a lot to you you'll want to give thought to the availability of multifarious TV sets in your particular application.

The IIc allows for either forty or eighty column displays, to accommodate the bandwidth of either a television of a monitor. This is handy, but it also speaks to the limitations of the carryability... another non-word... of the computer. Much of the business software available for the IIc is restricted or useless under the forty column mode. As such, it has to be in the presence of the much rarer computer video monitor to be functional.

Finally, the system has a single drive built into it. While there is provision for plugging a second into it through a rear mounted connector, this is represents another thing that can't be carried in the carrying case. Despite the manuals notes to



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the contrary, any Apple system is a lot nicer and more useable with two drives.

C for Compatible

The clone builders will tell you that the only way to build a computer which is completely compatible with all the hardware and software of the Apple II + is to build one which is identical to the Apple II +. The IIc is decidedly not this and, as such, there is a meaningful amount of II + software which won't run on it. We found a few fairly obscure things that confused it.

Some video games are a bit funky on the system, for example. However, most of the major games houses are producing IIc versions of their aliens and secret passageways, so this shouldn't be too great a hassle.



The really major incompatibility of the system is one which has been designed into it. While the IIc will handle most II+ software, it won't handle any of its hardware at all. The Apple's expansion bus is gone from the IIc, it's "peripheral cards", as they stand, being integrated into the motherboard itself. There is no possibility of expansion at all.

This isn't as bad as it sounds. There is already a lot of power in the machine. However, for many users, the fun of the II + is in popping in the latest music synthesizer, modem or other widget. This is, sadly, impossible on the IIc.

There are a few other glitches. For example, the eighty column card lives in the now virtual slot three of the system. It can be activated... either programmatically or manually... with PR#3. However, returning to the forty column mode requires that one manually hit the reset key.

Continued on page 38

### ANNOUNCING A SPECIAL ADDITION TO COMPUTING NOW! IN NOVEMBER



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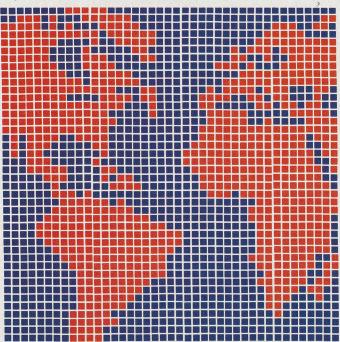
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In addition, we introduce a number of regular features for Software Now! readers, including a review of video games, a browse through the latest books, comments on the latest public domain software and listings of the latest comercial software to be repleased.

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## The Apple IIc Reviewed



#### Soft Shoulder

The system's native language is still Applesoft, trusty anachronism that it is. There are a few very minor enhancements to it, such as having the escape I, J, K and L editing sequences work in the eighty column mode. The IIc features four cursor movement keys... two of which handle the vertical directions... it would have been a trip to have used these instead.

There are several low level niceties in using Applesoft, however... like better high resolution graphics, a volume control for the sound and a larger selection of control key combinations for use in sophisticated programs. They keyboard is also capable of generating a more nearly complete character set, cheerfully spewing out things like curly brackets and tildes.

The system supports full upper and lower case characters on the tube in both its forty and eighty column modes

While compatibility with Apple II+style Applesoft is unquestionably an invaluable feature I think it would have been a good trip... considering that the computer is being advertised for use by potential users who aren't computer literate heads... to have had the thing bundled with a second, more user friendly BASIC along the lines of the Microsoft deals for the Commodore and IBM machines.

#### Other Stuff

It's unlikely that the designers of the Apple IIc were really thinking heavily about it as a programmer's toy. It's probably fair to say that the largest portion of the amorphous mass computer market simply doesn't write much BASIC code... it buys computers to

write letters and balance its congregate cheque book. Most of the introductory software which came with our review system... while written in Applesoft to a large extent... emphasized the applications of the system

emphasized the applications of the system rather than its programming potential.

The applications which come with the IIc are obviously the result of heavy duty manifest thought. They are splendid. The disks are all loaded with something called ProDOS, Apple's latest enhancement to DOS. It's slick, and, while slightly slower than old style DOS it does have lots of features that partially make up for this.

The IIc will also run quite happily with regular DOS 3.3.

The applications which accompany this thing are both well thought out and nicely documented, complete with the aforementioned thick manuals and some very carefully planned tutorial and demonstration disks. They consist of a number of general groups of software types.

The first group is comprised of a number of introductory things. There are bits to introduce a complete novice to BASIC, Logo and so forth. There's a thing called the Inside Story... which some grown up probably put quite a lot of work into... involving someone called Sherlock Capslock and Nancy Novice. It's easily among the stupidest pieces of software ever written for the Apple... you'll probably laugh your backside off.

Decorum prohibits me from suggesting what you'll actually laugh off.

There are a number of program disks for the thing... some of which contain some reasonably worthwhile bits of software. The most amusing is something called *The Ap-*

ple At Play. It's pretty cool. There's a thing that does two voice music... tricky with a one voice sound system... through the Apple's speaker. There's a financial package... actually, that one has a few bugs in it. Its amortization chart section told us that in the seventeenth year of our twenty-five year mortgage the bank would start paying us.

By the twenty-second year it'll be paying us more than we're paying it now.

There's also a really excellent program to play "real Las Vegas blackjack"... replete with graphics and sound effects. It's authentic, too... it cheats every so often. It may just be playing by peculiar rules... there are a few things about it that aren't wholly fathomable.

Most notable about this disk is the inclusion of a Broderbund video game, a nasty little alien battle called *Space Quarks*. It's pretty slick, and good for at least four or five hours of zapping away.

The serious software available for the system is also extremely nice. We got something called *AppleWorks*, a large integrated doodah which encompasses a file management system, a word processor and a spreadsheet. It's all pretty good stuff.

To begin with, Apple Works appears to utilize the IIc's upper bank of sixty-four K of RAM, inasmuch as you get fifty-five K to play with, as a buffer for word processing or as raw memory for spreadsheet models. This is somewhat better than you can ever hope for on a sixty-four K system, as some of the available RAM is invariably taken up by the program itself.

The Apple Works package is based on its own private DOS which, while making it faster than the ProDOS based software also necessitates starting it with one disk and running it with another. This seems unnecessarily complex for an integrated package, one which should boot and be ready to rip.

The whole package is menu driven, making it easy to switch from one application to another. There are a few concepts pinched from the Macintosh built in, too. All three applications use compatible data formats, allowing information to be moved between them using a "clipboard" function. Thus, for example, part of a spreadsheet could be included in a document being created with the word processor.

The menus of Appleworks are done up with some graphics which, while a party at first, start to wear after a while. This is a drag, as there is no way to bypass them. The way the whole thing is supposed to happen is that each successive menu overlays the previous one, looking like an index card laid on a desk.

Actually, they look like Apple II+ style peripheral cards... I wonder if that means something.

None of the three applications packages exhibited any signs of weirdness or lurking bugs... all of them seemed to be pretty straightforward to use. The word processor especially was a reasonable party... but then, I can get into word processors a lot better than I can spreadsheets and data base managers.

The word processor, while not quite so powerful as some of the really sophisticated CP/M and MS-DOS based packages, would be more than adequate for doing letters, essays, reports and short manuscripts. It has all the wizards and gremlins built in,

looking for a computer to run applications software on. However, there are a few catches in this. The Apple IIc's 65C02 processor is a somewhat enhanced version of a very antiquated chip. To have used a more sophisticated microprocessor would have meant that the machine would have had to have foregone all the existing Apple compatible software. On the other hand, this chip puts a definite ceiling on the capabilities of the computer.

Software with the sorts of capacities of Lotus 1-2-3 or dBase III will be forever beyond it.

The applications which come with the system and the legions of others that are available for it are not shabby. If you re-

dle with computers, both in a programming sense and with hardware. The manual warns and even occasionally threatens you against uncasing the system and looking inside. That's a bit pointless, though... there's nothing inside to play with. The IIc is an appliance.

If you want an Apple to hack with, either save a bit more cash and pop for a IIe or an old II+... or, dare I say it... get a compatible

I think that the portable aspect of the IIc is largely overstated... I would suspect that the carrying case will be used to lug books in by most owners. However, the thing works well as a stationary system. It's comfortable to use, small enough so as to leave a bit of desk space left over and attractive enough so as not to require a sticking it in a drawer every time someone comes over for tea and crickets.

It's not a bad box and, while there are numerous areas in which one can see potential improvements and enhancements in it, it qualifies as being a good overall computer. It's only a bit obscenely expensive for what it is which, by the standards of Apple, is pretty reasonable.

Argh, Billy... th' "c" be standin' fer "crunchy". 'ere, lad, put some ketchup on that keyboard y' be chompin' on...



### Specs

System: Processor: Memory: Disks: Apple IIc 65C02 128K

1 Single density single sided 5 1/4" floppy built in, provision for second external drive.

Software Available: Operating System: Software Included:

Most Apple II+ software

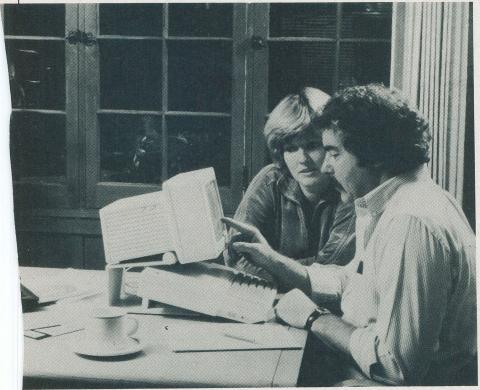
ProDOS

Applesoft, ProDOS, assorted demonstration disks

Peripheral Interfaces:

Serial port, printer port, games paddle, headphone jack, RF modulator connector.

Manufactured by: Apple Computer
Distributed by: Local Apple dealers
Suggested Retail: \$1895.00



including search and replace, block operations and manifest freaky tab configurations you'll probably never try to use.

#### To C or Not to C

Yes, that is the question.

The Apple IIc is one of the least expensive real Apples you can get. It's kind of cute, portable to the same degree anything weighing ten or fifteen pounds is if you stick it in a bag with a handle and is reasonably well thought out. It comes into the world with a huge software base already waiting for it and a pretty decent support structure.

The IIc is not a bad choice for someone

quire software of about that level then the IIc is certainly worth considering. A few hours in front of the beast at the market stall of your local computer peddler is probably called for.

The IIc is a splendid games system. It can take advantage of lots of existing games and, presumably, newer and slicker games will become available for it taking advantage of the extended instruction set of the 65C02 and the IIc's double high resolution graphics and its additional sixty-four K of RAM.

The system will, I think, be an eventual disappointment to anyone who likes to med-

## First Look at the IBM



Yes, friends, they've dug up another PC at IBM. This one offers a new, more powerful processor, enhanced features and, yet, compatibility with earlier systems.

#### by Steve Rimmer



o, anyway, we were sitting around the cave one day bashing on a couple of yak skulls, trying to get some rhythm up, when Gronk... Gronk's the hairier one with the family of bats living under his eyebrow... Gronk picked up this funny looking rock and rolled it across the floor.

We all kind of stared at this for a moment. Suddenly Gronk got really excited and put a stick on top of the rock and rolled the stick across the floor on the rock. Gronk kind of looked at this for a moment. He jumped up and made this strange noise that sounded like a gazelle when you club it.

He kept making the noise over and over again. "Wheel... wheel... wheel..."

Gronk kept jumping up and down and banging on the yak skulls and attempting to verbalize about the limitless possibilities of this funny looking rock. It took everyone else a while to figure out what he was on about. The rock didn't have any pointy bits and couldn't be used for braining anything. I mean, we're a reasonable lot, but all this speculative science fiction stuff is asking a bit much when you've only had fire for a couple of generations.

However, none the less, Gronk was slavering on about rooms that would move by themselves and creatures made of rock that would work while we watched them at it. He must have been going for hours.

He probably would have rambled on for days, actually, except that after a while Sleg got woken up by all the hammering. He crawled up from the back of the cave and picked up the funny looking rock. He eyed it suspiciously.

"It'll never fly, Gronk old thing." said Sleg at last. "How're you gonna package #2"

Gronk shut up about then, and went back to looking at the rocks. Sleg gave him a long speech about the necessity of realizable inventions and then crawled back for another snooze. After a while Gronk got up and started painting on the wall of the cave.

"What's it gonna be, Gronk?" I inquired.

"A sixteen bit computer based on the 80286." He said absently.

I pondered on this. By the gods of the swamp and the peat bogs, this was going to fox the archaeologists.

#### **New Blues**

Released on August fourteenth... just after an IBM research team returned from an expedition to the Sarenghetti with dirty hands... the IBM PC AT is the latest in what looks like a series of computers produced along the lines of Jaws or Friday the Thirteenth. However, unlike these notable B movies, the PCs seem to be getting considerably better with each successive sequel.

The new PC looks different from the outside on in. Even the case is different... it looks a great deal slicker, complete with an ignition key. Actually, it looks a lot like Joe Sutherland's JLS case. Naw, couldn't be.

The unusual IBM keyboard hasn't exactly been abandoned in the AT, but it has been de-martianized a bit. The return key is about the size of a small beagle and considerably fewer obscure symbols decorate the key caps. On the other hand, the shift key is still inconveniently located one row up from the bottom and ESC is way over on the numeric pad.

Happily, the keyboard and the computer are connected with a curly cord, rather than an infrared link.

The AT is based on a new Intel processor, the 80286. The 8088 that drives the IBM PC, while considerably more sophisticated than the eight bit 8080's and Z80's that preceded it, is still a bit of a compromise, especially when compared to some of the really slick chips that have emerged of late, such as the 68000. The 80286 offers a superset of the instructions of the 8088, making it compatible with software written for the PC's processor. At the same time, advanced characteristics of the new chip mean that faster and more sophisticated software can be developed for the AT.

The AT, as a system, is compatible with most IBM PC based hardware and software, so there is already a fairly extensive software support industry waiting for it.

The new processor allows for, among other things, memory expansion up to about three megabytes. The hardware of the system will also support forty megabytes of hard disk storage, making all this RAM fairly useful.

#### Two Reelers

There are two basic configurations of the PC AT available. The cheap and nasty machine... for people who think that a Mercedes is an economy car... features a quarter megabyte of memory and one disk drive. One disk drive may be all you need... these things hold something over a megabyte. The system costs \$6149.00.





If you have two Mercedes and just can't think of what to do with this week's pay cheque you might want to consider sending it to me, care of this publication. Alternately, there's the deluxe AT, with a half megabyte of memory, a floppy drive and a twenty megabyte hard disk. It costs \$8,915.00.

The new computers run IBM PC-DOS version 3.0, which, obviously, supports all this silicon. However, for the first time on any stage IBM is also offering IBM PC XENIX as a choice of operating systems.

The XENIX package makes the system look like a UNIX based mainframe... sort of... allowing up to two other terminals to be associated with it. The XENIX package allows for full multi-user multi-tasking parties and features all the shells and pipes and generally inhuman commands that UNIX is famous for.

A powerful lot of toys, this.

The system hardware is also capable of

supporting realistic multi-user activity. It offers six free expansion slots... two are used by the disk drives. The system supports the new 80287 math co-processor to make software that crunches a lot of numbers chew faster. This is an important consideration in a multi-user environment, as the processor can still only do one thing at a time.

The graphics facilities of the system are comparable with those of a number of the enhanced PC compatibles, with eight colours of graphics and sixteen of text.

#### Old Tech

While certainly not the quantum leap of the PC itself, the AT is a decidedly enhanced computer. It corrects for many of the limitations of the original system... while, albeit, leaving a few still ticking away... and looks a lot better in the deal.

The AT is, I think, the best kind of enhanced system. Some care has been

taken to make it compatible with its predecessors, something which IBM isn't noted for doing in its mainframes. Users of it will immediately have lots of PC software to choose from, with the expectation of better stuff coming down the pipe as the software houses get turned onto the new hardware.

The AT is also a far better answer to the issue of compatible systems than was Apple's recent shotgun legal action. Rather than making the inevitable example of a few dealers, IBM has secured its position in the high end market by producing a computer which offers better value for de bucks.

The PC AT is a pretty decent looking machine, one which we'll be having a closer look at in coming months. It's powerful, cost effective for the high end user and promises a whole new range of sophisticated software.

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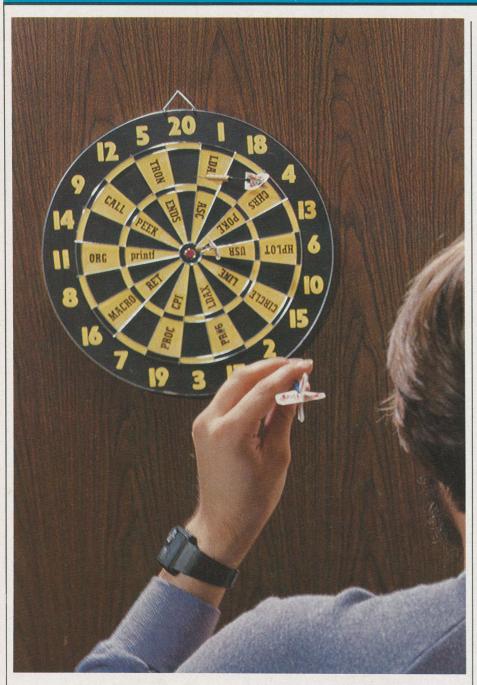
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## A Plethora of Languages



Long ago, when the world was young and simple, there was but one language, spoken by all, the language of gods and men alike, the language of reason, or thought, yes, even of poetry. However, the ages have grown more complex and you just can't do everything in BASIC anymore.

by Steve Rimmer

he choices are manifest and as confusing as can be imagined. When one first perches one's self before the ol' tube and begins to consider the next step in writing a large program, the initial leap... the selection of a suitable language... is momentous indeed.

There are so many things to consider, after all. Language packages are almost as varied as the computers they run on. Like systems themselves, there are few bad languages... there will be, however, quite a number of turkeys for any given application.

A complete understanding of each of the packages available to you... its merits and funkinesses... should guide you in finding something that will get your software out of your fingers and onto a disk. However, the process is a bit weird... there are a lot of things to meditate on.

This article will look at the things you should be thinking about when you decide to write a program. In it, we'll consider the applications for a number of the popular computer dialects...

and reasons for selecting them.

It may not leave you any less confused... but at least you'll know why everything looks so strange.

#### The Big Word

Before we get into the specific languages available to the programmer, it's probably worth while having a peer at the various criteria one should have in mind when developing a large piece of software. Most of these will also apply even if you are only thinking about concocting a better tic tac toe game.

There are, to begin with, three classifications of languages, to wit, assemblers, compilers and interpreters. We'll begin with an overview of these.

Assemblers are pretty well universally the province of the machine language programmer. They are characterized by a largely one to one relationship between the words you use in your program and the resulting code. In order to write programs that actually work in assembler you have to specify every byte that goes into the resulting object file.

This is tedious, to be sure... although there are some ways to cheat on the process, as we'll see shortly. However, there are advantages in assembly language programming which cannot be realized in any other way.

A compiler is like an assembler except that each word in your program will cause a whole subroutine to become part of your eventual program. As such, each word in your source file can invoke a whole function or operation, rather than simply altering a single register or moving a single byte.

Even before we get into the hairy bits, this can be seen to have both advantages and disadvantages. To be sure, it's much easier to print your name by saying something like

#### printf('My name');

than it is to write a twenty or thirty byte subroutine to do it. However, at the same time, the former application will almost certainly generate more code.

There are other catches as well. We'll get into them.

Both assemblers and compilers are characterized by the way they deal with programs. In order to write a program for a compiler language you will need not only the compiler itself but, in most cases, a separate text editor. You see, in order to write a program you have to type the source code into a text file, exit the editor,

compile the program... and, possibly, link  $\mid$  it...

we'll get to that too... note the inevitable resulting error messages, return to the editor, fix the bugs, exit the editor, re-compile the program... it's a long and oftentimes tedious process.

Both assemblers and compilers are also

Assemblers are pretty well universally the province of the machine language programmer.

characterized by their lack of protection for the computer, more so in the case of the former, which allows you to concoct any permutation of machine level instructions you fancy and, thereafter, run them and create any number of uncool situations for the machine. Hanging the system under the auspices of one of these things is a very real possibility.

The final class of languages is the one which most computer owners are most intimately aware of, that is, the interpreter. The most common of these by far is the Microsoft BASIC interpreter. Virtually any computer worth thinking about has one of these things available for it in some form.

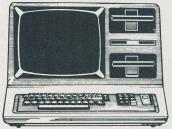
An interpreter is a combination text editor and subroutine museum. The text editor allows you to enter program text directly into the interpreter and then run it. Running an interpreter program is a somewhat different process than the analogous action of running something that has been compiled. An interpreter text file is a set of directions for the language to call large subroutines as specified by the program.

An interpreter program is always a text file... it never exists as a machine code program. As such, it cannot run unless it is in the presence of its parent language.

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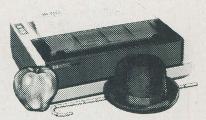
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## A Plethora of languages

Assuming that there are no bugs in the interpreter itself, an interpreted program can never hang. The interpreter will only allow the program to run with a specified set of keywords, and each keyword corresponds to a complete, working routine.

On the other hand, interpreters suffer from two serious drawbacks. The first is that they are tediously slow... the process of fetching each line of a program, parsing it to extract its keywords and their parameters, converting the parameters into a representation the computer can fathom and then running a long, complex subroutine to actually perform whatever it is that's to be done... it's all extremely time consuming.

Secondly, an interpreter can only support the commands that are written into it. Most interpreter BASICs are pretty rich, but if you want to do something the language hasn't allowed for, you generally have to go through some pretty hairy gyrations. See "BDOS in BASIC" elsewhere in this issue for some examples of this.

This, however, introduces a few limitations. Most variations on the theme of the Microsoft BASIC compiler have a few minor syntactical incompatibilities with their corresponding interpreters, or, at best, feature a few commands that don't do exactly the same things in both environments.

An interesting problem that one occasionally runs into is that something can be done by compiled code that can't be realized with the interpreter. For example, you may find you have a program which runs fine when it's compiled but runs out of memory under the interpreter. This makes perfect sense... the interpreter ties up about thirty kilobytes of RAM that are free for a object program. However, BASIC compilers are not optimized for speed. Developing code using the BASIC compiler as you would, say, a C compiler is likely to get you a bit aged before all the bytes are smiling.

The final drawback in using BASIC compilers is that they produce code... ahem, more to the point, they produce

most compilers immediately bless your file with something called a *run time*. This is a massive block of code which can perform all of the possible functions of the language you are writing in. It has a fixed set of entry points.

Thereafter, compiling your program involves simply adding any required literals and parameters to the file and a string of jumps and calls into the run time.

This has a number of advantages. It means that the compiler is a great deal easier to write, and very much faster in operation than it could be if it performed a straight up inline translation of your source into object code. It produces smaller object files than an inline approach would provided that your program is larger than a certain size. For "certain" read "massive".

Most compilers reach optimum code densities from source files that could not be typed in by a single human being in the time left before the sun goes nova.

In using a BASIC compiler, for example, the run time package is usually about thirty kilobytes long. This means that the program

#### PRINT "SHAVE ALL CATS"

would be about thirty-two K in length.

Other languages produce considerably denser code, which is one of the reasons for using them.

This run time situation has another aspect to it, one which many software developers don't get into until after all the disk drives have cooled down again. If you write a program... in any language... the source file is your property. The object file that results from the compilation of that source may be... or it may not.

Many compiler manufacturers attach a number of strings to their run time packages. You may find, for example, that you are not allowed to distribute the run time at all, and that every user of your software has to own a copy of the compiler. This will go a long way towards making your software unaffordable, as many compilers live in the rarified atmosphere of the five hundred to a thousand dollar range... probably costing more than your package.

Alternately, you may have to pay a royalty on every copy of the run time you ship. Note that this is different from paying for every copy you sell.

Some other software houses require the payment of a one time fee for the priviledge of distributing code which contains the run time. Again, this is worth checking out... some of these fees can be a bit horrific.

Finally, most compilers worth their salt will allow you to distribute your object code



A disk based system, such as this Heath, has no resident language and as such, can run any language one needs.

#### Anteaters

There are, of course, more things to think about. This article runs for several pages.

An interpreter is easily the quickest and least painful way to develop code. The combination of a BASIC interpreter and its accompanying BASIC compiler makes for a really hot way to create applications software... you can debug things to your heart's content in the warm safe womb of BASIC and then, when everything's all set to go, compile the resulting program file to enhance its speed and avail it of additional memory.

ground swells, monsoons and deluges of it. Code density is actually a vital issue in some applications... it's the next one we'll look at.

The concept of a compiler and the reality of one are actually quite different. One imagines that when one includes an instruction to print a string in a compiled program that the compiler will scrutinize the little troll, determine what it's up to and then include a subroutine in the file to handle the works. In fact, this isn't how things go under most compilers.

When you go to compile a source file

fairly freely. Many require the inclusion of a notice somewhere visible to the effect that some of the code is proprietary to whoever it is that made the compiler.

It's probably worth pointing out that virtually all compilers place copyright and identification notices in their run times, with most including serial numbers as well.

#### Down The Road

One area of languages which a lot of programmers talk about is *portability*. As you get into writing larger applications you will probably start thinking about running your programs not only on your present system but on new computers as they become available.

Assembler programs are not at all portable... they are entirely unique to the operating systems, and very often to the actual hardware, for which they are written. Moving an assembler program written for, say, an IBM into, say, a Macintosh, would require a total rewrite of the code.

Many compiler manufacturers attach a number of strings to their run time packages.

Macro assemblers can be used to write sort of transportable code. You can write a macro program in such a way as to allow you to move the main program to another system and simply rewrite the macro library. The structure of your program will be preserved... you'll just have to re-invent all the low level functions.

The most ubiquitous language available is C... it's generally regarded as being the best choice for writing highly portable code. Most new systems are blessed with C compilers before they even get particularly sophisticated assemblers, so packages which are intended for introduction early on in the life of a new computer are best done in C.

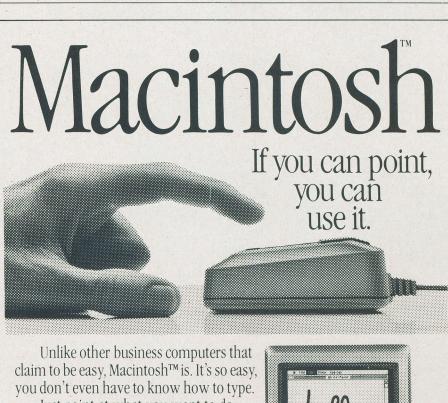
There are a number of catches to C, however, the most noticeable of which is that while most implementations of C are similar, almost no two are identical. As such, porting C code to a new system will still leave you with quite a lot of patching in most cases before you'll have a running object file.

PASCAL is fairly transportable, with implementations for most of the popular machines having made their way into the light. For example, the Macintosh has a PASCAL compiler but lacks one for C at the moment. However, PASCAL is rather less standardized even than C, partially due to

the so called "standard" PASCAL being largely useless as a real world programming language.

It was, in fact, written as a teaching tool.

The enhancements to standard
PASCAL are fairly straight up, but every
implementation handles them differently. As



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## A Plethora of languages



Many applications call for the attributes of several languages.

such, moving PASCAL code from one compiler to another often produces some heavy problems.

While it was never intended to be so, Microsoft BASIC is surprisingly portable. Its incompatibilities lie predominantly in the varieties of syntactical differences around its disk handling commands, but these are relatively trivial and easy to debug.

Debugging is, in fact, the final area to consider in choosing a language. It can be a royal pain, as many otherwise fine dialects offer few or no debugging facilities... something to be concerned over if you're contemplating a large program.

Assemblers offer the best debugging facilities... which are, not surprisingly, the hardest to get into. Machine language debuggers will allow you to step through every instruction in a program and examine the results. The better ones allow you to trace a program symbolically, so you can have your source file built into the debugger in a sense. However, making all this work requires an intimate knowledge of low level programming. It's anything but ideal for big applications.

At the other end of the spectrum, BASIC programs are a genuine party to debug. BASIC features numerous debugging aids built in, and it's a simple matter to install temporary traps in a program to see what it's doing.

Compiled languages are a middle ground, with widely varying debugging facilities. C Packages, for example, often feature no debuggers at all. Many of the structured BASICs are about the same. The intermediate level languages, like PASCAL may have some error messages and the like built in... Turbo PASCAL, for example, is fairly good in this respect.

You can, of course, put temporary traps in compiled programs too, but this is a bit tedious for large applications, as it means a minimum of two passes through the compiler to place the trap, observe the results and then remove the trap and fix the problem.

The debugging of compiler programs will take considerably more time than writing them unless you are omniscient or talk fluently to silicon.

#### Mosquito Bytes

Having looked at the general considerations involved in choosing a language, it's probably worth while looking at the most commonly encountered beasts you'll have to choose from. Of course, your choices may also be coloured by things like which languages you have available... or can afford.

The lowest level of programming is done with an assembler.

This is usually a two part process... you use an assembler to translate your source code into a relocatable file, or in the case of a simple assembler into a hex file... and then a linker or a loader to produce a runnable object file.

If you want to write the tightest possible code an assembler is the only way to approach the task. Small utilities which you want to boot quickly will almost always be done in assembler.

Most forms of "tricky" code is also exclusively the province of assemblers. Things that must relocate themselves or interface in any way with the operating system just can't be done in higher level languages.

Assembler code is the slowest possible thing to write, as you must provide for every detail of the operation of your program. Nothing will be provided by the assembler itself, which is simply a translating mechanism. As such, for any given program, the source written in assembler will be the largest possible file, and, as such, the most cumbersome.

A macro assembler is the next step up from a simple assembler. It allows you to create a quasi-higher level language of your own devising by writing blocks of code... complete functions... which can be sucked into the source file in place of keywords. A complete look at macros can be found in the July 1984 edition of Computing Now!.

Macro assemblers are considerably easier to use than simple assemblers. They require a more complete understanding of how to manipulate the complex operation of an assembler, along with entailing a grasp of a larger vocabulary of pseudo-ops and directives. While they allow for most of the tricks available under a regular assembler, they tend to produce less dense code if one uses them to their best advantage.

A C compiler is one step beyond a macro assembler and, in a sense, many C compilers are little more than sophisticated macro assemblers along with very large libraries of macros.

Programs written in C produce object code which is about as dense as one can hope for under any compiler. Many C compilers do not use run time packages at all, but compile inline. This is practical because C primitives are extremely simple and don't tie up too much space.

Compiling a C program can be a bit of a labour. Some compilers, such as Supersoft C, translate the C source file into an assembler source file, which is then handled as one would a normal assembler program. This process involves the invocation of three or four separate steps. While the final code

may run extremely quickly, the compilation can be glacial.

Of course, C code which is assembled in this way can be debugged as if it were an assembler file, a decided advantage.

Programming in C, for the average programmer who is working his or her way down from BASIC, is usually only nominally easier than programming in assembler. While fluent C programmers can spew out code like it was their mother tongue, C is a very nasty little language, and takes a long time to get into.

PASCAL is a bit easier than C. It requires the same sort of tricky structuring, but has much higher level functions, requiring less responsibility on the part of the programmer.

However, PASCAL compilers almost universally include large run time packages, resulting in fairly large object files. Object code derived from a PASCAL source is usually pretty slow.

I've been quite impressed with the Turbo PASCAL compilers...

they offer fairly good code density, a clever

built in editor and lightning fast compilations. They, however, feature the catch of a fee for the distribution of the run time.

Structured BASIC packages... we looked at two of the most common of these in the January 1984 edition of Computing Now!... are the next best thing to programming in BASIC. Despite their name they're hardly structured at all. Furthermore, they use virtually the same keywords as does Microsoft BASIC with largely the same syntax. Most BASIC programmers will be able to get into a structured BASIC, such as CBASIC, CB80 or SBASIC, in a couple of hours.

Structured BASICs produce pretty sloppy object files... much less dense than the results of C or PASCAL, but not quite so loose as the output of a BASIC compiler. However, they offer somewhat more flexibility than does BASIC, considerably more speed in some cases and the opportunity write code with a word processor. This last bit isn't entirely frivolous... once you get used to it using an editor to create text files will become quite handy.

Finally, there is BASIC itself... the vir-

tues of which have probably been sufficiently expounded upon.

#### Link

There are few things more likely to produce a cold feeling in the pit of your stomach than getting three quarters of the way through a project only to realize that the language you decided to write it in isn't really up to the task

Being conversant with a number of programming languages is an exceedingly valuable capacity... it makes choosing the most optimum programming tools a great deal easier. It's well worth writing a few dummy applications to get familiar with the nuances of several languages.

At the very least you'll keep yourself from re-inventing the wheel when there's a Canadian tire down the street having a sale on steel belted radials. More to the point, though, you'll be able to get the very most out of your system by producing programs that allow you to apply the best of your skills and use the best of your hardware.

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# **BDOS** in **BASIC**



Microsoft BASIC is a party so far as it goes... but when you finally reach its limits you're usually pretty well stuck. Here's a look at a way to expand it enormously by accessing the operating system of your machine.

#### by Steve Rimmer

espite the power of many of the large disk BASIC's now available, particularly behemoths like Microsoft's CP/M based things, it is still very often the case that one wants to write code which the language either can't handle at all or wants to take its time over to such an extent as to make doing it impractical.

At this point many programmers start thinking about compiler languages, like PASCAL or C, expensive BASIC compilers, such as BASCOM or, finally, beginning to explore the largely untrodden subterranean world of interfacing machine language subroutines to BASIC programs.

I saw that shiver run up your spine and leap into the air from your shoulder. Few things seem more daunting than stepping out of the comfortable world of a BASIC interpreter into the typhoon of random bits and nastiness beyond.

Fortunately, machine language from BASIC is only about three quarters as impossible as most people think it is. There are a number of ways to approach it both successfully and without monsterous amounts of work. We're going to look at one of the neatest ones here.

#### Them Calls

The CP/M 2.2 operating system provides for thirty–six "BDOS calls"... basic low level I/O and disk functions that it's prepared to do for you through its own internal code. The form of a typical BDOS call is

Load C with the function number Load D.E with a pointer if needed or Load E with a character for output Call location five

The results of the call, if any are to be expected, will return in A if they be a byte or HL if they be a word.

This is all probably pretty commonplace stuff if you program in assembly language. However, BASIC does not provide for any way to call the BDOS directly... largely because BASIC is supposed to be unhangable and using the BDOS incorrectly will largely negate this aspect of it. Many of the BDOS functions are duplicated in BASIC and, as such, not having them is rarely a problem. Function nine, for example, prints a string pointed to by D,E. It does much the same thing as the BASIC PRINT.

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## **BDOS in BASIC**

However, there are a number of things that the BDOS offers which simply can't be managed with BASIC's existing repertoire of commands and functions. For example, function thirty-two sets the USER area. Files which are written into one user area are invisible if you happen to be logged into a different user area. This is a handy thing... you can put incidental or scratch files in a different user area to keep them from getting confused with files you are interested in.

Sadly, BASIC offers no way to change the user area.

If you implement the program accompanying this article, however, you'll be able to access all the features of the BDOS from BASIC. The concepts involved will also allow you to create more sophisticated machine language subroutines if needs be, thus enhancing the power of BASIC considerably.

To begin with, lets return to something that slipped by a few moments ago. We said that values were passed to BDOS in C and D,E. You probably were thinking that these were some sort of variables. You're right... sort of. They're registers, you see.

The Z80 microprocessor has eight eight-bit registers which are normally used. These are A,B,C,D,E,H and L plus the flags register, which isn't usually accessed directly. These things can be treated like bytes, that is, you can store any value from zero to two hundred and fifty-five in them. However, it's more common that the latter six are treated as pairs of registers, so that, for example, D,E is used to hold sixteen bit numbers. A sixteen bit number can hold any value from zero to sixty-four K.

This being the case, D.E. for example, can hold the number of the location of any byte of memory in the machine. When we use D,E in this way it's referred to as a pointer.

If you put the string "There once was a hermit named Dave" in memory starting at location one thousand, a pointer to the string would be the number one thousand. In most cases strings in memory are terminated by specific bytes which aren't used as anything else. The CP/M function nine call uses a dollar sign. So, for example, by loading D,E with one thousand and blasting this call we would be saying to print the string starting at location one thousand until the next dollar sign.

Now, if you say

#### A\$ = "There once was a hermit named Dave"

somewhere in a program BASIC will store this string in memory. There's no way of predicting where it will go, but you can find out where it is once it gets there. BASIC kindly provides for this. If

#### PRINT VARPTR(A\$)

the system will print out the address at which A\$ starts. Well, no, actually, just to make things weirder, it will actually print out the address of where the length and pointer for the contents of A\$ live. Ahem. You see, BASIC stores stuff a bit weird.

When you define A\$, BASIC creates three separate entries

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Modem7. Allows you to communicate with any CP/M based system and download files. Complete details were in Computing Now! November 1983.

PACMAN. You can actually play PAC-MAN without graphics, and it works pretty fast.

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D. A sorted directory program that tells you how big your files are and how much space is left on the disk.

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STOCKS. This is a complete stock management program in BASIC.

SEE. Also known as TYPE17, will TYPE any file, squeezed or not allowing you to keep documents in compressed form while still being able to read them.

Order as AFS #1 and specify system BISHOW. Th ultimate file typer, BISHOW version 3.1 will type squeezed or unsqueezed files and allow you to type files which are in libraries (see LU, below). However, it also pages in both directions, so if you miss something, you can back up and see it again.

LU. Every CP/M file takes up unnecessary overhead. If you want to store lots of data in a small space, you'll want LU, the library utility. It permits any number of individual files to be stored in one big file and cracked apart again.

RACQUEL. Everyone should have one printer picture in their disk collection.

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NSBASIC. Large disk BASIC packages. such as MBASIC, are great... and very expensive. This one, however, is free,, and every bit as powerful as many commercial programs. It's compatible with North Star BASIC, so you'll have no problem finding a manual for it.

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VFILE Easily the ultimate disk utility. VFILE shows you a full screen presentation of what's on your disk and allows you to mass move and delete files using a two-dimensional cursor. It has heaps of features, a built-in help file and works extremely fast.

**ROMAN.** This is a silly little program which figures out Roman numerals for you. However, silly programs are so much

CATCHUM. If you like the fast pace and incredible realism of Pacman, you'll go quietly insane over Catchum... which basically the same game using ASCII characters. Watch little "C's" gobble periods while you try to avoid the deadly "A's"... It's a scream.

> Order as AFS #2 and specify system

OIL. This is an interesting simulation of the workings of the oil industry. It can be approached as either a game or a fairly sophisticated model.

CHESS. This program really does play a mean game of chess. It has an on-screen display of the board, a choice of colours and selectable levels of look ahead.

DEBUG. The DDT debugger is good but this offers heaps of facilities that DDT can't and does symbolic debugging... it's almost like being able to step, trace and disassemble through your source listing.

DU87. The older DUU program does have some limitations. This version overcomes them all and adds some valuable capacities. It will adapt itself to any system. You can search, map and dump disk sectors or files. It's invaluable in recovering damaged files, too.

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LADDER. This is... this program is weird. It's Donkey Kong in ASCII. It's fast, bizarre and good for hours of eye strain.

QUIKKEY. Programmable function keys allow you to hit one key to issue a multicharacter command. This tiny utility allows you to define as many functions as you want using infrequently used control codes and to change them at any time... even from within another program.

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## **BDOS in BASIC**

```
110 ':
120 ':
         BDOS CALLS FROM BASIC
130 ':
          Copyright 1984 (c)
140 :
          Steve Rimmer
150 ':
170 MVIA$ = CHR$(&H3E)
                        'MVI A,
180 \text{ MVIC} = CHR$(&HE)
                        'MVI C,
                        'MVI E,
190 MVIE$ = CHR$(&H1E)
200 \text{ LXIH} = CHR$(&H21)
                         'LXI H,
210 \text{ LXID}$ = CHR$(&H11)
                         'LXI D,
220 LDA$ = CHR$(&H3A)
                         'LDA
230 \text{ STA} = \text{CHR} (\&H32)
                         'STA
240 \text{ LHLD}$ = CHR$(&H2A)
                         'LHLD
250 \text{ SHLD}$ = CHR$(&H22)
                         'SHLD
260 \text{ CLL} = CHR$(&HCD)
                         'CALL
270 RET$ = CHR$(&HC9)
                         'RET
280 BDOS$ = CLL$ + CHR$(5) + CHR$(0)
290 DEF FNML(A$) = A$ +
     SPACE$(195-LEN(A$))
300 DEF FNVP$(C$) = CHR$(PEEK(VARPTR
     (C$)+1) + CHR$(PEEK(VARPTR(C$)+2))
310 DEF FNMC(X) = MVIC + CHR(X)
320 DEF FNADR(X) = CHR(X-(256*INT)
     ((X/256))) + CHR$(INT(X/256))
330 GOTO 710
340 'FUNCTION CALLS
350 'CHARACTERS IN IN A$, OUT IN B$
360 ON BDOS GOTO 380,390,400,410,420,
     430,440,450,460,470,480,490,500,
     510,520,520,520,520,520,520,520,
     520,520,530,540,550,560,570,580,
     520,580,590,520,520,520
370 PRINT: PRINT " +++ BDOS Function
     Error +++ " : END
380 B$ = " " : S$ = FNMC$(1) + BDOS$
     + STA$ + FNVP$(B$) : RETURN 'CONIN
390 S = FNMC$(2) + MVIE$ + A$ + BDOS$ :
     RETURN 'CONSOLE OUTPUT
400 B$ = " " : S$ = FNMC$(3) + BDOS$ :
     RETURN 'READER INPUT
410 S = FNMC$(4) + MVIE$ + A$ + BDOS$ :
     RETURN 'PUNCH OUTPUT
420 S = FNMC$(5) + MVIE$ + A$ + BDOS$ :
     RETURN 'LIST OUTPUT
430 B$ = CHR$(32) : S$ = FNMC$(6) + MVIE$
     + A$ + BDOS$ + STA$ + FNVP$(B$) :
     RETURN 'DIRECT I/O
440 B$ = CHR$(32) : S$ = FNMC$(7) + BDOS$
     + STA$ + FNVP$(B$) : RETURN 'GET IOBYTE
450 S = FNMC$(8) + MVIE$ + A$ + BDOS$ :
     RETURN 'SET IOBYTE
460 A$ = A$ + "$" : S$ = FNMC$(9) + LXID$
     + FNVP$(A$) + BDOS$ : RETURN 'PRINT
     STRING
470 B$ = CHR$(LEN(B$)) + CHR$(0) + B$:
     S =FNMC$(10) + LXID$ + FNVP$(B$) +
```

```
BDOS$ : RETURN 'CONSOLE BUFFER
480 B$ = CHR$(32) : S$ = FNMC$(11) +
     BDOS$ + STA$ + FNVP$(B$) : RETURN
     'GET CONSOLE STATUS
490 B$ = CHR$(32) + CHR$(32) : S$ =
     FNMC$(12) + BDOS$ + SHLD$ +
     FNVP$(B$): RETURN 'GET VERSION
500 S = FNMC$(13) + BDOS$ : RETURN
     'RESET DISKS
510 S = FNMC$(14) + MVIE$ + A$ + BDOS$ :
     RETURN : 'SELECT DISK
520 B$ = " " : S$ = FNMC$(BDOS) +
     LXID$ + FNVP$(A$) + BDOS$ + STA$ +
     FNVP$(B$): RETURN 'GENERAL DISK
     OPERATIONS
530 B = CHR$(32) + CHR$(32) : S$ =
     FNMC$(24) + BDOS$ + SHLD$ +
     FNVP$(B$): RETURN 'LOGIN VECTOR
540 B$ = " " : S$ = FNMC$(25) + BDOS$ +
     STA$ + FNVP$(B$) : RETURN 'CURRENT
     DISK
550 S = FNMC$(26) + LXID$ + FNADR$(DMA)
     + BDOS$ : RETURN 'SET DMA
560 B = CHR$(32) + CHR$(32) : S$ =
     FNMC$(27) + BDOS$ + SHLD$ +
     FNVP$(B$): RETURN 'GET ALLOCATION
     VECTOR
570 S = FNMC$(28) + BDOS$ : RETURN
     'WRITE PROTECT DISK
580 B$ = CHR$(32) + CHR$(32) : S$ =
     FNMC$(29) + BDOS$ + SHLD$ +
     FNVP$(B$): RETURN 'GET VECTOR
590 B$ = CHR(A) : S$ = FNMC(32) + MVIE$
     + CHR$(USER) + BDOS$ + STA$ +
     FNVP$(B$): RETURN 'GET/SET USER
     AREA
600 'MAKE AN FCB
610 A = STRING (35,0)
620 MID$(A$,1,1) = CHR$(D) 'DRIVE NUMBER
     IN D (A=1)
630 MID$(A$,2,11) = N$ 'PADDED FILE NAME
     IN NS
640 RETURN
650 'EXECUTE FUNCTION
660 GOSUB 340
670 Q$ = FNML$(S$+RET$)
680 DEF USR O=VARPTR(Q$)
690 X = USRO(65)
700 RETURN
710 '
720 ' WORK SPACE
730 ' YOUR PROGRAM GOES HERE
740 '
750 'Example using function 9 to print a
     string
760 A$ = "There once was a hermit named
     Dave" + CHR$(13) + CHR$(10)
770 \text{ BDOS} = 9 : GOSUB 650
```

790 'Example using function 32 to change the user area 800 PRINT "These are the files that currently exist in user 0" 810 FILES 820 PRINT 830 USER = 4 : BDOS = 32 : GOSUB 650 840 PRINT "The user area is now 4. Here's the disk directory." 850 ON ERROR GOTO 1000 'TRAPS FILE NOT FOUND 860 PRINT 870 FILES

900 'Example of using function 22 to create a file." 910 PRINT "Creating a file in user area 4." 920 D=0 : N\$ = "FLAT"CAT" 930 GOSUB 600 'ASSEMBLE A PSEUDO FCB 940 BDOS = 22 : GOSUB 650 950 FILES 960 PRINT 970 PRINT "Returning to user 0." 980 USER = 0 : BDOS = 32 : GOSUB 650 990 END 1000 RESUME 880 'TRAP FOR ERROR

into RAM. First off, there's the text of A\$. In this case the text resides in the text of a program. Unless you programmatically alter A\$ at some point, the text of your program will continue to be the actual location for the characters in the string

880 ON ERROR GOTO 0

To look at this another way, if you were to locate the text of A\$... which we'll do in a moment... and alter it, LISTing your program would show the altered text in the line that holds the stuff to go in A\$.

If you change A\$ in the running of the program, such as by using a string function like LEFT\$ or MID\$ or by assigning it different characters, BASIC will copy the new A\$ from your program text into memory, and thereafter ignore the A\$ in your pro-

Now, in order to keep track of things BASIC creates a table of entries, or pointers, with one entry for each string. Each string entry consists of one byte and one word. The word is a sixteen bit pointer to where the text of the string actually is. The byte is the length of the string. This is why strings cannot be longer than two hundred and fifty-five characters.

The VARPTR function returns a pointer to the location of the length byte. However, since this is always immediately followed by the pointer to the string's text, we can locate the actual text by the following gyrations...

#### P = PEEK(VARPTR(A\$) + 1) + 256 \*PEEK(VARPTR(A\$)+2)

The variable P will hold the location of the first byte of the string.

If you've been following this you will probably have figured out how to use BDOS function nine from BASIC. You would load C with nine, D,E with P, as derived above, and then call location

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## **BDOS** in **BASIC**

five, this being the jump to the BDOS. Logically this should work and, despite the vagueness of Murphy's law, actually does.

The only hassle is that BASIC doesn't provide a way to directly manipulate the Z80's registers, either.

#### Old One Ninety Five

There is a way around all this. It involves a magic number. The magic number is one hundred and ninety-five.

First of all, consider that machine language instructions are just bytes, or, if you want, characters. As such, you can define them using the CHR\$ function from BASIC. Stick a bunch of the right CHR's together in a string and you have a small machine language program. If you put the string in memory and use BASIC's USR function to call it, it will execute.

Assuming that it doesn't hang the computer and that you've terminated it with the byte that the Z80 interprets as the return from a subroutine instruction when it's done your program will continue executing with the line after the USR call. Doing a USR call to a string is a bit of a slice as it's hard to predict where the string will be. However, you can get around this with VARP-TR and the above magic number. You see, the Z80 instruction for JMP... analogous to the BASIC GOTO... is &HC3, or, in decimal, a hundred and ninety-five. If you have a string that's a hundred and ninety-five bytes long the VARPTR of that string will point to, essentially, a JMP instruction... even though that's not what BASIC thinks of it as. Immediately following this will be the location of the program string.

The secret of using machine language instructions in strings, then, is simply to pad them out to one hundred and ninety-five characters. Since the pad characters come after the RET instruction of the routine they can be anything you like... spaces work fine.

#### Call For Pizza

The program in listing one is a demonstration of how to use the BDOS calls from BASIC by working with machine language strings. The strings that comprise individual machine language instructions are defined up top. The defined functions are short hand for constructing the strings.

In order to use this program you would assign the number of the function you want to the variable BDOS... set up any other parameters which are appropriate to the particular call you had in mind... we'll get to that... and GOSUB 650. This will, in turn, compile the appropriate machine language program in S\$, define the USR function to point to S\$ in memory and then execute it with USR. The parameters passed between BASIC and the USR function in this case are dummies.

There are several interesting points involved in some of these things.

Function one, which is compiled in line 380, waits for a character and then returns it in B\$. There are a number of things that can be said about this. To begin with, while it is easy to compile a program into a string and execute it, getting something back out of the program is difficult because of BASIC's predilection with moving things around. Thus, getting the returned character back is a bit involved.

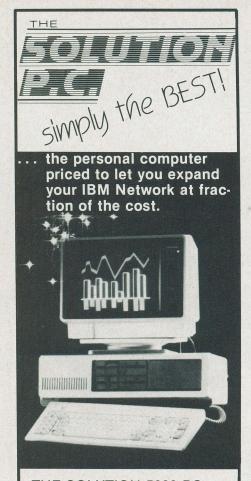
We can get around this by creating a dummy string, B\$, and making its location a pointer to store the character returned by the BDOS call at. In order words, we will get the location of B\$ through PEEKing around the VARPTR and then compile that into the string after an STA... store the the A register... instruction. It's a bit involved so, rather than write it out every time it's used I've made it into the function FNVP\$.

Remember how we said that literals are stored in the program text itself... well, here's a good example of this. If you use function one and then list the program the last character gotten by the function will appear between the quotes after B\$. This may cause the thing to list a bit strangely if the last character was a line feed or something else unprintable.

In fact, some of the functions seem to freak out if you use a literal B\$ and, as such, I've assigned B\$ the value of CHR\$(32). As this is not a literal the byte is stored in high memory rather than in the program itself. However, this doesn't work with all the functions either and, what's worse, it's not consistent between the various versions of Microsoft BASIC. Some experimentation will be in order. There's a slightly more elaborate, but foolproof technique outlined later on.

```
750 GOTO 940
760 'SEE DMA
770 C$ = ""
780 IF PEEK(\&H80 + (32*B)) = \&HE5 THEN
790 FOR X=\&H80 + (B*32) TO (\&H80+B*32)+11
800 A = PEEK(X)
810 IF A>32 AND A < 128 THEN A$ = CHR$(A)
     ELSE A$ = ""
820 C = C + A
830 IF X=&H80+(B*32)+8 THEN C$ = C$ + "."
840 NEXT X
850 RETURN
860 'DO BUBBLE SORT OF DIR$
870 WHILE F=0
880
      F = 1
      FOR X=0 TO Q-1
890
900
      IF ASC(DIR$(X)) > ASC(DIR$(X+1))
          THEN SWAP DIR(X), DIR(X+1):
          F = 0
910
      NEXT X
920 WEND
930 RETURN
940 'DO DIRECTORY
950 DIM DIR$(64)
960 DMA = &H80 : BDOS = 26 : GOSUB 650
970 D = 0 : N\$ = "????????BAS" : GOSUB
980 \text{ BDOS} = 17
990 GOSUB 650
1000 B = ASC(B\$)
1010 GOSUB 760
1020 C = PEEK(VARPTR(B\$)+1) + 256 *
     (PEEK(VARPTR(B$)+2))
1030 POKE C,32
1040 IF C$ <> "" THEN DIR$(Q) = C$ :
     Q = Q + 1
1050 IF B <> 255 THEN BDOS = 18 : GOTO
     990
1060 Q = Q - 1
1070 GOSUB 860 ' CRUDE SORT
1080 FOR X=1 TO Q
1090 PRINT DIR$(X) SPACE$(12 -
     LEN(DIR$(X))) " ! ";
1100 NEXT X
```





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## **BDOS in BASIC**

This program is very good at trashing itself and hanging the computer, by the way... usually for the most trivial errors. Make sure you save it *before* you run.it.

Successful use of most of these functions will be based on at least a passing acquaintance with how to set things up for them. This isn't very hard... consult the CP/M interface guide... it should have come with your operating system disk... for the sweaty details.

Function two prints the character in A\$ to the screen... yes, that is exciting, to be sure. Functions three and four are a bit neater... they exchange data with the RDR: and PUN: logical devices. Function five outputs directly to the printer port in most systems. Function six does what is called direct console I/O... that is, nothing gets trapped by the operating system.

Functions seven and eight allow you to read and manipulate the IOBYTE. The IOBYTE, which controls the assignment of logical to physical I/O devices in the few systems that don't choose to ignore it, lives at location three in memory. If you ever come up with a use for it you will probably find that PEEKing and POKEing the thing works equally as well.

Function ten gets a line of input from the console. It's a bit better than INPUT because, among other things, it supports all of CP/M's control codes, like control X to scrap a line and control R to retype it. To use this you create a string of spaces of a length equal to the maximum length of your expected input. The function will return if you try to type in more characters than you've allowed for.

When the call returns RIGHT\$(A\$,LEN(A\$)-2) will contain the string you've typed and ASC(MID\$(A\$,2,1) will be the number of characters you actually entered... useful, as A\$ will still be padded out with spaces.

Function eleven, the console status call, is most useful if your BASIC lacks a functional INKEY\$. It will tell you if there is a character waiting at the keyboard while you are busy doing something else.

Function thirteen is one of the more useful ones. If you want to change disks while executing a program you can call this thing and, thereafter, you'll be able to write to the newly inserted disk without fear of BDOS errors.

Function fourteen will allow you to log into another drive. The string A\$ should be set to CHR\$(DRIVE) before you call this one.

The general disk operations, functions fifteen through twenty-three and function thirty, are all called with A\$ holding an FCB, or file control block. This is CP/M's internal representation of a file name. While FCBs are a fairly tricky juggling act in some cases, the subroutine at line six hundred will allow you to synthesize the basic components of one to play with these things.

A more complete explanation of FCBs is to be found in the alteration guide.

A basic FCB is thirty-two characters long. The first byte holds the drive specification for the file to be meddled with. A zero means to use the current drive, one is drive A, two drive B and so on. This is placed in our fake FCBs according to the value of the variable D.

The next eleven characters hold a padded file name. This means that the first eight bytes hold the name... with spaces added to fill things out if the name is less than eight characters long... and the last three hold the extension. The dot, purely a human convenience, is ignored.

The rest of the FCB holds bytes which are, for the most part, manipulated by the operating system for its own convenience. It's

sufficient, at this level, to simply assure that they are all set to zeros when the call happens.

#### The Demo

This program contains all the code needed to use the thirty–six function calls. They should be fairly system independent, functioning properly on any machine running CP/M 2.2. The demonstration code, beginning with line 710, runs through a few of the more useful routines.

To begin with, note that all the actual machine language instructions are loaded into sort of mnemonic strings at the start of the program. Make sure you get these right... the thing will be fatal to debug.

Secondly, there are a number of functions which make the strings a bit less complex to specify. Once again, errors in these will send the program into never never land.

The strings themselves, beginning at line three eighty, are all pretty well standardized. You shouldn't have to alter them, except for the problem with the dummy B\$ we looked at a while back... what's more, you probably shouldn't play with them until you have a thorough grasp of what they do.

The demonstration program illustrates the syntax for a number of types of calls. First of all, it prints a string using function call nine. This could have been done much more simply with PRINT, of course, but it's the thought that counts. Furthermore, doing it this way is considerably faster.

Having printed something on the tube the thing will change the user area to level four and issue the FILES command to get a directory of the disk. You probably won't see anything here... most users don't put anything in the higher areas. It will then create a file called FLAT.CAT using call twenty two and, finally, return to user area zero.

Listing two is a somewhat more sophisticated example. It replaces the work space code of listing one. It does a simple sorted directory of a disk using the BDOS calls that set the DMA and the ones that search for directory entries. It then performs a really crude bubble sort, leaving the array DIR\$ with an alphabetized listing of what's on the disk.

The directory routines in BDOS are pretty tricky. To begin with you have to set the DMA, or direct memory access, buffer location to somewhere that you can predictably access later on. We could fool with more strings but, since CP/M allows for a built-in DMA buffer we might as well use it.

The CP/M DMA buffer runs from &H0080 to &H0100. Having used function twenty-six to point to there in line 960 all disk accesses will thereafter pass through this buffer until it's changed again. In other words, if CP/M wants to pass you a block of disk data... or has received one from you... it will do so by looking at this buffer.

To read the directory you specify the files you want to read for in an FCB. You can use question marks for wildcard characters. For example, the file specification in line 970 means all files with the extension BAS. A string of eleven question marks would mean, simply, all files.

Having set up the FCB you would first search for first, function seventeen, and then repeatedly search for next until no more files could be found.

The status of a search can be determined by the value of the A register. If it's set to two hundred and fifty-five when the call returns the file could not be found. Otherwise, a file name meeting the specification will be somewhere in the DMA buffer.

At any given time after a search the DMA buffer will hold four file names. The one you want will be determined by the setting of the A register... busy little troll. Multiply the value by thirty—two to get the number of bytes into the buffer where the file name you want resides.

This code fragment uses yet another trick to get around the problem of the dummy B\$. As you can see, the B\$ for the general disk operations string, line 520, is a space, rather than CHR\$(32). As this will always return an unprintable character running this program will make line 520 unlistable. Thus, the code in lines 1020 and 1030 POKEs a space back into B\$ after the returned value has been read.

#### Pay Phones

Using the BDOS from BASIC is nowhere near as easy as straight BASIC programming, nor is it anything like as forgiving. You should SAVE every iteration of a program before you run it. At best it may modify itself if you've done something wrong... at worst it will hang the system.

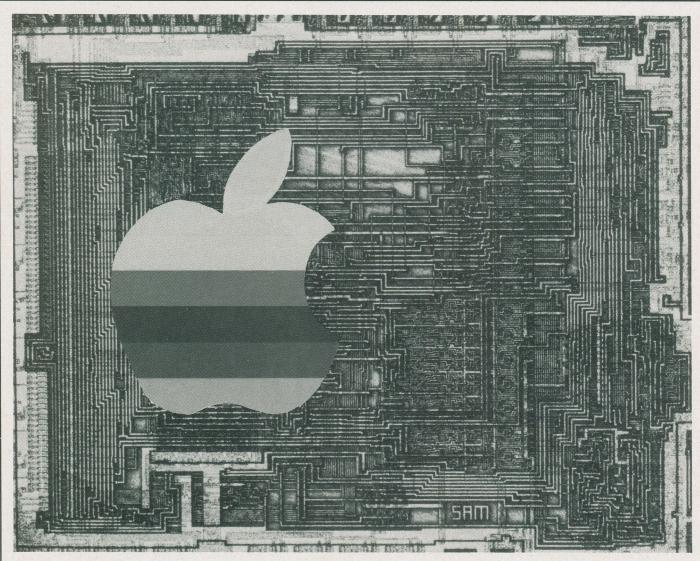
However, as you can see, there's a lot you can do with these techniques. A complete understanding of just how to manipulate machine language instructions as character strings will allow you to write some pretty tricky code... and do things that BASIC probably doesn't know it can handle.

The horizon recedes even as you read this.





# Two Apple Hacks



The Apple II+, and systems compatible with it, have access to one of the most munificent outpourings of accessory fiberglass in the known universe. Most of it works perfectly, some works well and a meaningful amount doesn't work at all. Here's a look at two such cases, and some fixes for them.

#### by Richard Gerson

here are a lot of good things to say about Apple compatible computers... they're powerful, inexpensive and very, very flexible. The same system can be a video game, a businessman's tool, a beginner's system or a specialized dedicated controller. However, for many users the real joy of the Apple is in making it just a little bit better.

Herein we present a duet of hacks for popular Apple compatible peripherals. neither will take will more than an evening to perform and the whole works encompass only a few dollars worth of bits. They also don't involve too much skill with a soldering iron, although they aren't recommended for total beginners.

#### Blasting 2764's

The Unitron EPROM writer is a fairly useful beast if you are working with two or four K chips... 2716's and 2732's. It has a "64" position on its DIP selector switch and that might make you think that it can burn

2764's as well.

In fact, the EPROM writer, with on board software in its PROM and a twenty-eight pin zero insertion force socket is similar to the Apparat EPROM writer. They both were set up to burn a twenty-four pin eight K Motorola EPROM, the MCM68764.

There really is no good reason to keep the option to burn the Motorola EPROM since it costs a stupendous amount and is rarely used in development work. Fortunately, with a bit of hacking one can exchange it for something much more useful, the ability to handle 2764's. The patch described here is simple, straightforward and requires no change to the on board software in ROM. The normal programming of the 2708 and 2716 EPROMs is not affected.

As a second issue, there can be considerable confusion about reading and burning 2732 type EPROMS with the Unitron EPROM writer. While we're cutting and soldering the thing we'll look at how to clear up the 2732 problems.

There are at least three different versions of the 2732 four K by eight bit EPROM. All three are currently used in systems and development work. Three of them, the Intel 2732, the Hitachi 2532 and the Motorola MCM2532, require twenty-five volts to reliably program them. However, some of these EPROMs differ in pinout with respect to address line A11, the output and chip enables and the high voltage programming pin. Most of this briar patch is at pins eighteen, twenty and twenty-one.

The other type of 2732 you will frequently encounter is INTEL's 2732A, which requires twenty-one volts for programming. This EPROM is guaranteed to bite the dust if more than twenty-one and a half volts is used. Note that the INTEL 2732 and 2732A have the same pinout.

**Cutting Up** 

This project should only take you about an hour to do and there are no changes required for the existing software in the PROM on board. It would be advisable to use an ohm meter to confirm that the traces to be cut actually go where they are supposed to go before you start hacking at them... it's not inconceivable that there have been multiple revisions of this card with varying layouts.

The EPROM programmer and personality modules.

Computing Now! October 1984

Beginning with the traces on the top, or component side, of the board...

- 1. Cut the trace between pin two of the green ZIF socket and pin seven of the 2764 dip switch socket... where the "personality module" would live.
- 2. Cut the trace between pin one of the 2764 sip switch socket and the 2.2 kilohm resistor below the socket.
- 3. Cut the trace between pin one of the 2764 dip switch socket and pin one of the 2732 dip switch socket.
- 4. Cut the trace between pins two and twenty-seven of the green ZIF socket. Note that this trace is on the component side of the pcb. If you are building the EPROM writer from a bare board, this is easy to do. In the built up version, the trace is underneath the textool socket.

There are two ways to get at this trace. The hard way is to very carefully unsolder this socket using a solder sucker, cut the trace and then resolder the textool socket back on the board. This way you may damage the traces going to the textool pins if you are not careful.

The second and best way is to use a drill press and a number fifty drill. Set the drill press limits to just a bit over a sixteenth of an inch or two millimeters of depth and drill through the fiberglass and, hence, the trace from the back of the board. This can be easily done by centering the drill three millimeters from pin twenty-seven towards the inside of the socket and between the two traces that straddle pin twenty-seven. With the board on a piece of wood you can easily drill through the trace that connects pins two and twenty-seven enough clearance so that you will not drill into the ZIF socket.

Be certain that no connection remains... check it with an ohm meter. If it does, scratch it away with a needle.

Next, let's proceed to the one cut required on the back, or solder side, of the board.

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Two Apple Hacks

5. Cut the trace between pin nine of the 74LS74 and pin nine of the 2764 dip switch socket.

The cuts are the easy part. Having gotten them together you'll now have to add a few things to the board. The following are the jumpers that have to be soldered onto the card.

6. Jumper pin one of 2732 dip switch socket to the junction of the 2.2 kilohm resistor and the cathode of the 1N914 diode below the 2764 dip switch socket. This will reconnect the 2708 module.

7. Jumper pin nine of the 2764 dip socket to pin one of the 2764 dip socket. Then run a jumper from pin one to ground at pin seven of the 7474. Also ground pin eight of the 2732 dip socket. This is to provide a path for the zener voltage.

8. Jumper pin seven of the 2732 dip socket to pin seven of the 2764 dip socket. This is to allow switching in the zener diode, thereby reducing the twenty-five volts to twenty-one.

9. Jumper pin nine of the 74LS74 to pin two of the textool socket. This is for the twelfth address line of the 2764 EPROM.

10. Jumper pin twelve of the 74LS04 to pin twenty–seven of the textool socket. This is for the programming pulse of the 2764 EPROM

The next level of hacking is in adding some additional parts to the board.

11. Solder a twenty-one volt zener diode, such as a 1N5250, between pin eleven of the 2732 dip socket and pin seven, with the cathode at pin eleven.

12. Solder a 0.1 microfarad forty-five volt monolithic capacitor between pin two of the 7406 and pin seven.

This is to suppress spurious voltage transients which can interfere with programming and damage the EPROM.

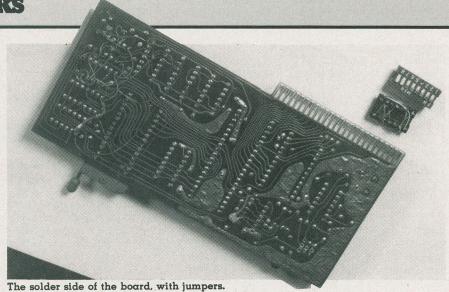
#### Personality

Having made all these changes you'll now have to build some new personality modules and change the dip switch settings.

The Intel 2732, which wants a twenty-five volt programming pulse wants a dip switch in the "32" module socket. Switches one through six should be closed, with position seven open. The EPROM should be in the lower twenty-four pins of the twenty-eight pin socket.

The Intel 2732A, which has a twenty-one volt programming pulse, should have the same personality module but switch seven should be closed.

The Motorola MCM2532, with a twenty-five volt programming pulse, needs a new personality module. You can make one with a dip header. Make the following con-



pin 2 to pin 13 pin 3 to pin 11 pin 4 to pin 9 pin 5 to pin 10 pin 6 to pin 12

The Intel 2764, the heart of the matter, also needs a new personality module. It goes in the "64" socket.

pin 1 to pin 4 pin 2 to pin 13 pin 3 to pin 8 pin 5 to pin 10 pin 6 to pin 12 pin 7 to pin 9 pin 11 to pin 14

These modifications complete you should be able to reliably program the new chips. If you're really daring you'll be able to make further hacks to the card to handle additional types of EPROMs but, for most users, this probably won't be necessary. The ones which it accepts, with the assistance of these alterations, should cover pretty well all of the EPROMs normally encountered in contemporary personal computers.

#### Taming the 128K Card

Having a large block of memory for use as a RAM disk on the Apple is a decided enhancement. It speeds up the whole system because disk access time is virtually eliminated. There are a number of RAM cards which can be used to perform this function... but the low cost cards available at some retailers are extremely attractive to many users. While they'll work under any of the Apple's operating systems, we'll be using CP/M as an example here. This approach will work with or without a language card in place... the Apple sees the extra memory as a peripheral rather than as more memory.

The low cost hundred and twenty-eight

K memory cards, originally available through Parts Galore, have had five major revisions since their introduction. The earlier ones had serious problems. Some of them would hang the system when another card was included in the peripheral card slots or lose their marbles after a few minutes on line. The LEDs would do strange things when the initialization program was run. They would also upset CP/M quite badly and prompt bizarre system crashes.

Much of this was the result of a common problem, which we'll look at presently.

The first and most important shocker is that the cards somehow passed their software tests. This of course means that one ought not presume that a test program, such as one called RAMTEST128K, is testing everything you need to have tested on your board.

The test results for an unmodified board are as follows.

TESTING SLOT 0
TEST ROM READ

STATIC TESTS DYNAMIC RAM TEST BANK 1-1 (C083) FINISHED PAGE D0

BANK 8-2 (C083) FINISHED PAGE DF FORGET TESTS LOADING SLOT 0 WAITING.

TESTING SLOT 0 LOADING SLOT 0 WAITING

TESTING SLOT 0 ENTER SLOT 3 TO TEST

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## **Two Apple Hacks**

From this test program it appears that the board is operational...but only to the gullible. It did not detect the problems that most users experience with these boards.

The Applesoft program called DEMO using DOS 3.3 also works... it appears to operate satisfactorily... in that the program completes its run indicates that it is doing something, somewhere in the card's RAM. Given this one might again presume that the Ramcard has passed this test. In fact many fruit vendors use these tests to demonstrate to potential buyers that the built up Ramcards they're selling work. It even looks good at home... at least until you try to do something useful with the card.

Sometimes, on power up of the Apple system with DOS 3.3, different LEDs will turn on and stay stuck on before any initialization of the card. The randomness of this should concern you... computers are supposed to behave predictably. Placing the boards in different slots did not change the results in my case. These LEDs suggest that a bank select problem might be at fault.

We're chasing the gremlins to ground. Don't touch that dial.

Often a Ramcard individually or together with another Ramcard causes the system to irrevocably crash when CP/M is booted. If CP/M boots and the  $A \triangleright$  prompt is obtained, the INIT program causes the system to crash. Sometimes the  $A \triangleright$  prompt goes away into limbo.

Often the card will behave itself for a time and then get flaky. When the prompt does return, strange things may happen on the screen. For instance, you may run INIT and come back with a prompt and a screen lightly sprinkled with garbage characters. The read LED locks on, presumably stuck trying to find nonexistent data or an improperly set up directory. Sometimes a bad board will initialize with INIT2 only to mindlessly lose the directory contents after a while.

At one point I tried to initialize the card as a pseudodrive C:. Doing a directory of this produced a collection of colons, actually the separators between a series of blank file names. Note that this is not the same as simply having no files on the disk. This thing thought that the directory was full but that all the characters in the file names were nulls.

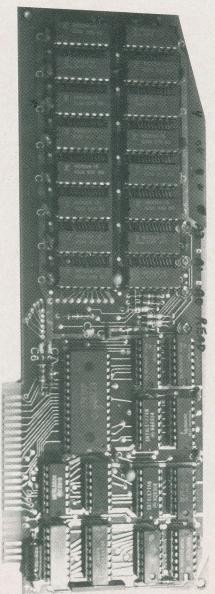
This could only be salvaged by erasing the whole directory and then PIPing the files I required to drive C for programing. This is not the way the Ramcard should work.

Other cards, such as an eighty column card, when placed on the bus with an apparently working Ramcard often cause the system to crash.

The Big Fix

Having rhymed off all this tribulation and negativity it will probably cheer you to no small end to learn that we're now going to get down to the task of making this obstinate beast function.

When I turned an oscilloscope loose on the card I found that strange things were going on as soon as the Ramcard powered up. The board was not resetting properly and the timing was off on some bus lines. No amount of careful swapping of the memory chips, the 3242 controller or TTL devices could ever have made the board function properly as it stood, despite what the guy might have said when you bought it.



The Memory card in all it's gory.. er, glory.

The first problem that I found was that the bypass capacitors on four of the bus lines were too small to be of any use in decoupling any noise or ringing on those lines. The value of the capacitors was causing improper shaping of two clock signals an address line and a device select line. The value of these capacitors should be between two hundred and twenty and three hundred and twenty picofarads. This can be remedied by replacing the twenty-two picofarad capacitors at C19, C20, C21, and C29.

The second problem was that the RESET signal from the CPU on bus pin thirty-one was not getting to the Ramcard. In order to fix this you must add a jumper to the two plated through holes near pin thirty-one.

Both of these modifications allow proper initialization and bank switching of the card.

The reason that these seemingly small changes make such a big difference to the operation of the Ramcard is because this card uses bank switching. The Ramcard appears to the Apple as eight banks of sixteen K each. The Apple sees only one memory space for this card, located at \$D000 to \$FFFF. This is only twelve K, so the remaining four K is switched in and out with another four K bank within the first twelve K, as required. Thus in a complicated way, using what the fruit has to work with, a full hundred and twenty-eight K can be added to your machine in one I/O slot.

There is a final catch. Unfortunately, because the pseudodisk driver routines are put into the Apple's I/O configuration block... the routines are quite large... the I/O block can't be used for much else when running the pseudodisk. There is thus a practical limit of two Ramcards per Apple because of the limited software I/O space.

The rest of the cards commonly installed in an Apple should be unaffected so long as the Ramcard is working properly.

## Moorshead Software Services

## Stockboy Inventory **Control Package**

When we first advertised this program, we would have been pleased with a fraction of the orders we received. On reflection we should have appreciated what a bargain it is. Inventory programs are generally pretty expensive and some of them are inflexible and some even badly engineered. You may find that even small inventories generate enrormous files.

Stockboy is a good, powerful, flexible bargain-priced package which will handle inventory for small businesses. We use Stockboy within Moorshead Publications for our own inventory control and it has stood the

Stockboy can:

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Stockboy is written in Microsoft BASIC, and is designed to be easily altered to suit your needs. It can be compiled using BASCOM if you desire. It is designed for use by non-technical operators

Available for: CP/M and PC formats

\$29.95 most systems \$34.95 for 8"

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MDM730 is one of the most powerful MODEM7 programs available . . . and the Computing Now! version of MDM730 incorporates features not available in the public domain editions. If you are into telecommunications, bulletin boards and downloading software your life will be full and meaningful with this code. For background on MDM730, see July 1984 Computing Now!. Consider the facilities.

- Terminal program which works at any baud rate.
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- User settable toggles for line feeds, ON-XOFF and
- Extensive help menus.
- Baud rate selection on the fly (or the spider).
- ASCII dump and capture.
- · Status menu
- Many more features.

In addition to all this splendor, however, we've added dialing support for the Apple version. While the standard MDM730 cannot dial unless it's hooked to a Hayes Smartmodem, we've added patches to it to allow it to do pin twenty five pulse dialling and to dial through the Hayes Micromodem II and the SSM card. The Computing Now! MDM730 will also

- Select a number from the library and dial it
- Accept a hand entered number and dial it
  Wait for carrier
- · Log you onto the remote system if it's free
- . Optionally autodial if the remote board is busy
- · Count the number of attempts at dialling the remote BBS

The Computing Now! MDM730 package is available for

- The Haves Micromodem II.
- The SSM 300 Baud modem card.
- The PDA 232C serial card with external modem.

The PDA 232C package includes versions supporting both the Smartmodem and a dumb modem with pin twenty five line control, such as the Novation AutoCat.

Also included with each package are utilities to permit easy alteration of the phone number library and the function key macro strings plus an extensive documen-

The source code file for this program is over a hundred and fifty kilobytes long. It cannot be hacked on a standard Apple. We patched it on a larger machine and downloaded it. As such, we're pretty sure that MDM730 with these features is unavailable elsewhere

Available for: Apple II + CP/M 2.2. systems

TRS-80 Model II (complete with the above applicable features)

Please specify modem version from above list.

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The original MDM730 code is in the public domain. We are offering this part of the program without cost. The charges for this package are for the patches created by Computing Now! and to defer the cost of handling and

This software is guaranteed to work correctly if properly applied. The serial cards on Apple and compatible systems must be installed in slot two with at least 48K of RAM running Microsoft CP/M 2.2. The PDA 232C version will require the availability of either a Hayes Smart-Modem or a modem with pin twenty five line control to dial. Users of the SSM card version may experience some difficulty in detecting extremely faint carriers on older versions of this card.

Where CP/M is shown, the following formats are available:

Apple II + CP/M (see below)

Access Matrix, Morrow Micro Decision, Superbrain, Xerox/Cromenco\*, Epson QX-10VD, Sanyo MBC1000, Nelma Persona, Kaypro II, Osborne Single Density\*, Osborne Double Density, Systel/Olympia, 3R Avatar, Attache, Televideo, Lobo Max-80\*, DEC VT-180, Casio FP-1000, Micromate, Zorba, 8 inch SSSD\*

\*Software marked with an asterisk is the higher price

MDM730 for the Apple II + CP/M requires two disks and is at the higher price.

Available for the IBM PC and genuine compatibles. **AppleDOS** 

For Apple II + and genuine compatible systems. TRS-80 Model II CP/M

Will operate under either Lifeboat or Pickles and Trout

## **Apple** Wordstar Fixer

compatible systems equipped with Videx type eighty-column cards do a number of unpleasant things to this

popular word processor. While there are simple cures for this... they all involve some delicate code hacking. The Fixer solves this problem. Place it on the same disk as your copy of WS.COM, type FIXER and after a suitable amount of disk noise, you will have APWS.COM on there too. This version of Wordstar includes special patching and unhooking code which runs each time you boot Wordstar, and makes your fruit behave as it should. It releases the control K's, translates the left arrow key to a delete character, and patches Unitron keyboards.

In addition, the fixer allows you to set some of the defaults of Wordstar which the MicroPro INSTALL package doesn't really get to. All of these features are menu driven in English for absolute non-technical opera-

Will run in either 44K or 56K CP/M.

Available for:

Apple II + CP/M only.

Ontario Residents add 7% P.S.T.

## DOSDIAI.

#### The Apple Terminal Package

There are plenty of terminal programs for the Apple II and its emulators. Some dial, some download. However, only DOSDIAL is this splendidly cheap.

DOSDIAL is a hybrid Applesoft and machine code package for fast operation and easy modification. It features a phone number library and automatic dialing. It operates on any fruit with a PDA 232C serial card and an autodial modem. A complete source file of the assembler code is included to allow it to be quickly patched for other serial cards.

Will work on any Apple + or compatible system with a PDA 232C serial card and an autodial modem.

Available for: Apple II +

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puter work for you.

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This program is designed for the total novice and it is designed to work accordingly. All you do is turn the computer on, slide in the disk and it takes over!

Requires Applesoft BASIC, 48K RAM and one disk drive.

Available for: AppleDOS only

Ontario residents add 7% PST.

#### Software Services.

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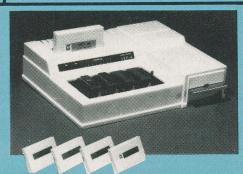


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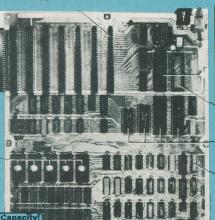
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# Hashing on the Apple



Sorts and searches are among the most sophisticated of microcomputer applications. There are miriads of techniques for handling them... here's a look at one of the most sophisticated ones.

by Jim Dawson

If you think micros are fast wait until you ask your Apple to do a sequential search of a thousand names in a file to find the one you want. "Hash" the record name, though, and your Apple will astound you by finding the whole record in less than half a second no matter how many records there are in your file. To top it all off, your micro will make its own fruit sauce out of a record name and the results are always good.

Sequential searches of data tucked away in RAM to find a particular record are pretty impressive as long as you don't have more than a hundred or so record names to check. The seconds begin to add up, though, as the number of records in a file increases. A sequential search of a thousand record names in RAM can take about ten seconds.

A "hashing" routine will enable your micro to dig up a record in less than half a second no matter how big the file is, and, since hashing is the basis of the virtually instantaneous retrieval of data in commercial programs and is a technique which all of us can adapt and use, it is worthwhile having an understanding of how it works.

Hash Pipes

When any string, be it numeric, alpha-numeric, or alpha, is hashed, an arithmetic algorithm generates a number value unique to that string. That number value can then be used as an index to file and retrieve a given record by serving as a pointer to a specific location in a storage array.

Imagine a simple two dimensional array as is illustrated in figure one with two columns, SA\$(N,0) and SA\$(N,1). For the sake of simplicity we will specify ten locations in each of these storage arrays. The first column, SA\$(N,0), will be used as the hashing table to store numeric values generated by the hashing algorithm. We'll get into more on this later. The second column will be used to file the records themselves.

Referring to figure one, suppose that SMITH, the first bit of data we wished to file, hashed to a value of five. Never mind just how this came to be for a moment... the mysterious algorithm emitted this number when it perused the string. Location five in the hashing table will have a value of one stored in it and SMITH will be filed in the first available location in the storage array string for data, SA\$(1,1). We have now created an index for SMITH in the hashing table which points to location one in the data storage array where SMITH has been filed. The name SMITH will always hash to a value of five in the hypothetical algorithm we are using here and from now on location five in the hashing table will always contain the pointer value of one.

If BROWN were the next name to be filed and it hashed to a value of eight, BROWN would be filed in the next free location of the data storage array, location two, and the value of two would be stored in the hashing table in location eight. We can think of the two as an index or pointer to location two in the data storage

array table.

If JONES came along next and hashed to a value of one, JONES would be filed in location three of the data storage array, the next free location, and a value of three would be stored in location one of the hashing table. Since the names JONES, SMITH and BROWN will always hash to the same values they did when they were first filed, any further reference to them will immediately provide a pointer indicating their location in the data storage array and they can be found at once without alphabetizing and without doing a sequential search of the names stored in the array.

Synonyms

You may wonder what happens, though, if two different names hash to the same value. Since we have a finite length to our hashing table and an infinite number of available names, sooner or later the problem will occur.

Suppose that GREEN were the next name to be filed and that it hashed to a value of five. SMITH has already hashed to five and the pointer stored in location five of the hashing table points to location one in the data storage array where SMITH has been fil-

ed away.

The program would first look in location one of the data storage array to make sure that GREEN hasn't already been filed there. It would find SMITH in SA\$(1,1), not GREEN as it might have expected. The program would then increment the pointer by a value of one, check to see the new location on the hashing table is free, file GREEN in the next free location of the data storage array, location four, and store the index value of four in the hashing table in location six.

An examination of figure two might help make the process a little clearer.

If, later on, GREEN were to be entered again, the name would as before hash to a value of five. Location five in the hashing table would still have a value of one stored in it which points to SMITH in location one of the data storage array, manifestly not GREEN. Again the program would increment the pointer by one and check to see what value was contained in the hashing table in location six. It would find four and it would then look in location four of the data storage array where it would find our friend GREEN.

Let's make the hypothetical program a little more useful and file some data to go with the names. If we set up a third data storage array column, SA\$(N,2), we can use it to file whatever data we wish to accompany SMITH, BROWN, JONES, and

GREEN, data such as their ages, height, weight, eye color and marital status... or perhaps the grades each obtained in the last test on the mobility of paramecia in magnetic fields.

In the skeleton demonstration program which accompanies this article the obvious choice of data was the mailing address for each record name. With very minor changes to the program you could use it to keep track of a running inventory of left handed widgets in stock, extra billing files for your uncle the doctor or for maintaining a schedule of Air India flights, ticket prices and departure times from anywhere in the world. The only limitation... apart from that of your imagination... is the maximum length of strings permitted by your micro, two hundred and fifty-five characters in the case of the Apple and related fruit.

#### The Demo

On booting the program you will first be asked to enter the file name. To avoid confusion, think of this as being the name you wish to give to a specific drawer in your filing cabinet or to a particular box of records. Perhaps customer addresses or subscriber list might describe the records your file will contain.

A pause of about seventeen seconds will follow while the subroutine in lines 520 and 530 is executed. These lines store a value of -1 in each of the thousand and nine locations of the three storage arrays. Later on, these -1 values will serve as flags to indicate empty locations... holes... in the storage string arrays.

In line 45 the length of the hashing table is more or less arbitrarily set at a thousand and nine in the DIM command. Typically, a prime number is used in defining the size of the hashing table. This apart, values much larger than this would soon overtax the memory of even an Apple with sixty-four K of RAM as the arrays filled with data and anything much smaller would not adequately demonstrate the power of a hashing algorithm.

The moral of the story is that the diskette is the place for storing large masses of data, not RAM, and this skeleton program can become a powerful tool for business or personal use as soon as you add a random access file to your diskette for data storage.

The program will next ask you for the name of the record you wish to file. Since this demo program was set up to file addresses you would enter a person's name or a company name at this point. In fact any alpha-numeric entry may be entered as a file name. The longish subroutine in lines 1000 to 1160 was written to allow for commas, colons, backspaces, and editing of the file name. Should you be using one of the ubiquitous clones, the subroutine will even accept upper and lower case characters.

In any case, you will find that the input line scrolls across the screen as you exceed forty characters to facilitate editing with the

backspace key to get rid of the inevitable typos.

Line 1070 is not needed for running the program and could well be deleted. It is included here to demonstrate the power of the input routine. Typing a control A will send your edited input to the printer and reduce N\$, the input data, a null string.

The only limitation on the name you choose to give your record is, in fact, the maximum length of a string variable. Obvious minor changes to the subroutine starting in line 220 would allow you to file alpha-numeric data of any kind about N\$, the record name. As things stand, though, you will be asked for such mundane items as the street address, city, province and postal code. Provision has been made for additional input in the entry labelled MISC. DATA. Pressing RETURN when you are asked for MISC. DATA will enter nothing for M\$ and you will end up with a simple address file.

If you plan to expand this program to a disk based filing system and file something other than addresses and phone numbers in it you could call the subroutine in line 1000 instead of the GOSUB 230 presently called in lines 740 and 900. This would give you full freedom to enter text data of any sort instead of the more rigidly formatted input called for in inputting an ad-

dress. Line 790 would be modified to redefine CL\$.

## **Hashing on the Apple**

```
490 HOME: GOSUB 560: REM <<<GOHASH - LOOK
                                                  1030 VTAB 1: GET S$
                                                       VTAB 1: PRINT S$;
    FOR EXISTING FILE>>>
                                                  1040
                                                       IF S$ = CHR$ (8) THEN GOSUB 1170:
500 RETURN
                                                  1050
                                                        GOTO 1030
510 END
520 FOR I = 1 TO LHT: SA$(I,0) = "-1":
                                                  1060 N\$ = N\$ + S\$
                                                       IF S$ = "cA" THEN HOME : PR# 1: PRINT
    SA$(I,1) = "-1":SA$(I,2) = "-1"
                                                  1070
                                                        N$: PR# 0:N$ = "": GOTO 1000 :REM 'cA'
530 NEXT
540 RETURN
                                                        IS IMBEDDED CONTROL-A
550 REM <<< HASHING ALGORITHM >>>
                                                  1080
                                                       IF S = CHR$ (13) THEN RETURN
560 SS$ = ""
                                                  1090
                                                       IF LEN (N$) = 245 THEN GOSUB 1150
570 HASHV = 0:A(1) = 0:A(2) = 0
                                                  1100
                                                        GOTO 1030
580 N = LEN (N\$)
                                                  1110
                                                        VTAB 15: HTAB 1: FOR I = 1 TO 40: PRINT
                                                        " ";: NEXT
600 N = INT (N / 2) * 2
610 FOR I = 1 TO N STEP 2
                                                  1120
                                                        CALL - 868: PRINT N$
                                                  1130
                                                        VTAB 1: HTAB 1: FOR I = 1 TO 40. PRINT
620 A(1) = A(1) + ASC (MID$ (N$,I,1))
                                                        " ";: NEXT : GOTO 1030
630 NEXT
                                                        N$ = "": VTAB 1: HTAB 1: FOR I = 1 TO
640 FOR I = 2 TO N STEP 2
                                                  1140
                                                        40: PRINT " ";: NEXT : GOTO 1030
650 A(2) = A(2) + ASC (MID$ (N$,I,1))
                                                        VTAB 9: HTAB 7: PRINT "cGcGcGcGcG"::
660 NEXT
                                                  1150
                                                        INVERSE: PRINT "ONLY TEN CHARACTERS
670 HASHV = 3 * (A(1) + A(2)) - 5 * (ASC)
                                                        LEFT!": NORMAL
     RIGHT$ (N$,1)))
                                                  1160
                                                        RETURN
680 \text{ HASH\$} = \text{STR\$} (\text{HASHV})
                                                        N$ = LEFT$ (N$, LEN (N$) - 1)
690 MF = VAL ( RIGHT$ (HASH$,1))
                                                  1170
700 \text{ HASHV} = \text{ABS (HASHV} - \text{MF} * 100)
                                                  1180
                                                        RETURN
                                                        HOME: PRINT SA$(V,1);: PRINT SA$(V,2)
710 P1 = HASHV
                                                  2000
720 IF P1 > LHT THEN P1 = P1 - LHT: GOTO 720
                                                  2005
                                                        VTAB 10: HTAB 14: INVERSE : PRINT
                                                        "DELETE";: NORMAL : PRINT " FILE - TYPE
730 VTAB 23: FLASH : PRINT P1: NORMAL
740 IF SA$(P1,0) = "-1" THEN GOSUB 230:
                                                        'D'": PRINT : PRINT : HTAB 14: INVERSE:
                                                        PRINT "REVISE";: NORMAL : PRINT " FILE
     GOTO 770
750 REM <<< ANOTHER RECORD NAME HASHED TO
                                                        - TYPE 'R'": GET DR$
                                                        IF DR$ = "D" THEN SA$(P1,0) = "-1":
     THIS VALUE >>>
                                                  2006
                                                        SA$(V,1) = "-1":SA$(V,2) = "-1": RETURN
760 GOSUB 860: RETURN
                                                  2007
770 GOSUB 790: GOSUB 310: RETURN
                                                        VTAB 22: HTAB 10: INVERSE: PRINT
780 REM <<< STORE DATA IN MEMORY - PRINT ON
                                                  2010
     SCREEN >>>
                                                        "ENTER REVISED ADDRESS ABOVE": NORMAL
                                                  2020
                                                        GOSUB 250
790 CL$ = S$ + CHR$ (13) + C$ + CHR$ (13)
                                                        SA$(V,2) = S$ + CHR$ (13) + C$ + CHR$
     + PC\$ + CHR\$ (13) + M\$
                                                  2030
800 \text{ SA}(NF,1) = N
                                                        (13) + PC\$ + CHR\$ (13) + M\$
                                                  2040
810 \text{ SA}(NF, 2) = CL$
                                                        RETURN
820 \text{ SA}(P1,0) = \text{STR}(NF)
                                                       REM <<<DIRECT ACCESS FILE SYSTEM>>>
                                                  10
830 NF = NF + 1
                                                  15
                                                       REM <<<
                                                                         BY
                                                                                       >>>
840 RETURN
                                                                     JIM DAWSON
                                                                                       >>>
                                                  20
                                                       REM <<<
850 REM <<< DUPE CHECK - GET OLD RECORD OR
                                                                                        >>>
                                                  25
                                                       REM <<<
                                                                       VE2DYA
     ASK FOR DATA FOR NEW RECORD >>>
                                                  30
                                                       REM <<<
                                                                 REVISION 4 - 03/84
                                                                                        >>>
860 V = VAL (SA\$(P1,0)): IF SA\$(V,1) = N\$
                                                                 COPYRIGHT 1984 (C)
                                                  35
                                                       REM <<<
     THEN DUPE = 1: RETURN
                                                  40
870 P1 = P1 + 1: IF P1 > LHT THEN P1 = P1 -
                                                  45
                                                       LHT = 1009: DIM SA$(LHT,3)
     LHT
                                                  50
                                                       D$ = CHR$ (4)
880 IF SA$(P1,0) < > "-1" THEN 860
                                                  100 HOME
 900 SA$(P1,0) = STR$ (NF): GOSUB 230: GOSUB
                                                  110 HTAB 10: PRINT "DIRECT ACCESS FILE SYSTEM"
     790: GOSUB 310: RETURN
                                                  120 SL$ = "DIRECT ACCESS FILER": VTAB 12:
995 REM <<< INPUT ROUTINE >>>
                                                       INPUT "TYPE IN FILE NAME --> ";ST$
1000 HOME : N$ = ""
                                                  130 K = 1:NF = 1
1010 VTAB 8: HTAB 6: INVERSE : PRINT "TYPE
                                                  140 PRINT "cGcGcG": REM 'cG' IS IMBEDDED
       IN NAME OF THIS RECORD": PRINT : PRINT :
                                                       CONTROL-G
      HTAB 12: PRINT "PRESS 'RETURN'": NORMAL
                                                       VTAB 20: HTAB 11: FLASH : PRINT "ONE
1020 PRINT: PRINT: HTAB 4: PRINT "(USE
                                                       MOMENT PLEASE!": NORMAL
      BACKSPACE & RETYPE TO EDIT)"
                                                  160 GOSUB 520: HOME
```

170 HOME: HTAB 5: PRINT SL\$;" - ";ST\$ PRINT "cGcGcGcGcG": GOSUB 405: IF DUPE = 1 THEN DUPE = 0: GOSUB 380 GOTO 180 190 200 IF DUPE = 1 THEN DUPE = 0: GOSUB 380 210 REM <<< THIS IS A NEW RECORD >>> 220 230 HTAB 4: VTAB 2: INVERSE : PRINT "PLEASE - NO COMMAS OR COLONS IN INPUT": NORMAL HTAB 4: VTAB 8: PRINT "RECORD NAME 240 HTAB 4: VTAB 10: INPUT "NO. & STREET 250 ; S\$ HTAB 4: VTAB 12: INPUT "CITY-PROV 260 ; C\$ 270 HTAB 4: VTAB 14: INPUT "POSTAL CODE -->" HTAB 4: VTAB 16: INPUT "MISC. DATA 280 ; M\$ 290 RETURN 300 REM <<< PRINT DATA >>> PRINT 310 320 HOME: VTAB 4: HTAB 13: PRINT "INFORMATION RECORDED" 330 PRINT "cGcGcG": FOR I = 1 TO 500: NEXT HTAB 6: PRINT "RECORD NUMBER"; NF - 1: PRINT D\$;"PR#1": PRINT SA\$(NF - 1,1);: PRINT SA\$(NF - 1,2): PRINT : PRINT PRINT D\$;"PR#0" 350 360 RETURN 370 REM <<< THE FILE EXISTS ALREADY >>> 380 VTAB 4: PRINT SA\$(V,1);: HTAB 1: PRINT SA\$(V,2)VTAB 10: PRINT "DO YOU WISH TO MAKE A 385 CHANGE? (Y/N)'';: GET YN\$: IF YN\$ = "N" THEN RETURN GOSUB 2000: GOTO 180 390 400 REM <<< GET RECORD NAME >>>

The Hashing Algorithm

405 GOSUB 1000: GOTO 490

A number of guite different arithmetic treatments of N\$ could have been used in the subroutine starting at line 550. The criteria

used in this program are as follows.

To begin with, the index arrived at by hashing has to be a positive integer between one and a thousand and nine. The values assigned to N\$ by the algorithm had to be as widely distributed in the hashing table as possible in order to allow for the greatest degree of randomness in the location of the holes... the free locations... in the table. Random distribution of holes becomes important as the table fills up and synonyms become more frequent.

Further, any value arrived at for P1, the pointer or index for the location of data in the storage arrays, which is greater than a thousand and nine has to be fitted into the index, that is, the hashing table, at a location within bounds without modification to the original data and without rehashing.

Finally, the routine has to be quick and the results haveto be

consistent.

The characters making up N are examined one at a time in lines 620 and 650 and their ASCII values are accumulated in

A(1) and A(2). A(1) is the sum of the ASCII values of every other character starting with the first one in N\$ and A(2) the sum of the ASCII values of every other character in N\$ starting with the second character.

In line 670 A(1) and A(2) are weighted to ensure adequate differentiation of similar data and greater randomness of distribution of P1 in the hashing table. A multiplication factor in lines 690 and 700 helps to bring P1 into the required range of positive whole numbers from one to a thousand and nine and to contribute to the more or less random dispersal of hash values in the

hashing table.

Once a given piece of input has been hashed by the algorithm, if a -1 flag is in the location in the hashing table indicates it is clear that this is new data and the program will ask for the additional data to go with N\$, the complete address in this case. Lines 770 to 830 will look after filing the appropriate data in the three columns of the storage array, SA\$(N,0), SA(N,1), and SA\$(N,2). NF, the next free location in SA\$(N,1) is incremented by one, and the program is ready to accept another record name.

If, however, line 740 indicated that another record name had hashed to the same value previously, that is, there is no -1 flag in the hashing table, a further subroutine is called starting in line 860. The first thing the program does is to check to see if the record is a duplicate in line 860. If it is, N\$ has already been filed. The data in the indicated locations in SA\$(N,1) and SA\$(N,2) is presented on the screen and the operator is asked if he wishes to change or delete it.

If the data filed in SA\$(N,1) turns out to be different, the pointer would increment by one in line 870. If a hole existsin the hashing table at this point the data is new and would be filed accordingly. The process repeats until one of two things occurs, to wit, if either a hole is found in the hashing table or the program discovers that it is dealing with a file that already exists. If a hole is found, the data is filed as before, and if the file already exists, it is presented to the operator for his disposal.

It is a bit complicated at first, but it works.

If you would like to watch this process at work, try filing KATER, W. followed by OWENS, B. Both of these names will hash to a value of 117 initially. You will see the figure 117 flashing in the lower left corner of your screen when you press RETURN after entering the names. You will find, though, that the pointer value stored in SA\$(117,0) will point to the location in SA\$(N,1) where the first of the two names is filed. Now type in PRINT SA\$(118,0) and you will find a pointer stored in this location hich will indicate where the second name is stored

#### **Future Files**

If the number of records in a file will never exceed a few hundred hashing is hardly worth the effort. When the numbers reach four hundred or so it is worthwhile considering hashing for speed. By the time you have more than seven or eight hundred records to search it is indispensible. Since available RAM can become a problem a disk based filing system is a corollary.

Now that you understand hashing you should be able to knock off a bit earlier. Just plug in the Apple and perch a "gone for the day" sign on your desk. Your fruit can look busy in your place.

CN!

Mey & Revised

# Computing Now! Bookshelf

# Best Seller List from the Computing Now! Bookshelf

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TRS-80, AND PET USERS BRAIN BANK
HB17
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This book shows you how to use the features of the ZX81 in programs that fit into the 1K machine and are still fun to

programs that fit into the 1K machine and are still fun to use. Chapter Two explains the random number generator and uses it to simulate coin tossing and dice throwing and to play pontoon,. Chapter Three shows the patterns you can display using the ZX81's graphics. It's animated graphics capabilities, explored in Chapter Four, have lots of potential for use in games of skill, such as Lunar Lander and Cannonball which are given as complete programs. Chapter Five explains PEEK and POKE and uses them to display large characters. The ZX81's timer is explained in Chapter Six and used for a digital clock, a chess clock and a reaction time game. Chapter Seven is about handling character strings and includes three more ready-to-run program - Hangman, Coded Messages and a number guessing game. In Chapter Eight there are extra programming hints to help you get even more out of your 1K ZX81.

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PH131: ZAP! POW! BOOM!
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BP115: THE PRE-COMPUTER BOOK
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AND COMPUTING
E.F. SCOTT, M.Sc., C.Eng.
As indicated by the title, this book is intended as an introduction to the basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming

There are occasions in the text where some background information might be helpful and a Glossary is included at the end of the book.

#### **BP72: A MICROPROCESSOR PRIMER**

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E.A. PARR, B.Sc., C.Eng., M.I.E.E.
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Centre D'Ordinateurs Atlantique Ltee.
419 Boul. Jessop, Rimouski, Que., G5L 7Y5
(418)722-0606
Ordinatuers: Commodore, Sanyo 550-555-555/2.
Impirmante Epson, FX 80, RX 80, RX 80FT etc.
Logiciels varies, service de techniciens et programmeurs. Moniteurs Hitachi, Commodore, Sanyo, Zenith.

Doneltronique Plaza Aurthur Buies, 411 Sirois, Rimouski, Que., G5L 8B2

J.L. Orninateur Ltee. CN 133 St. Germain Ouest, Rimouski, Que., G5L 4B6 (418)724-6800 MO CAT \$1.50

Computers: Apple, Commodore, Digital, Gescom, Sharp. Software: Ediciel, Logidisque, Vifi Sogiciel. Monitor: Zenith, Amdek. Printer: Epson, Centronics, C-IOTH Electronics Inc. Accessories: Talos.

Systems Ormic Ltee. ETI/CN 133 St. Germain O., Rimouski, Que., G5L 4B6 (418)724-6800 Authorized: Apple, Commodore, Eagle, NEC, Gimix, Epson, Centronics, Sharp. Complete library, full software, supplies and Ormic diskettes. Complete line of computer furniture.

#### Riviere-du-Loup

Le Messager Micro 298 Boul. Theriault, Ctr. Commercial, Rivier Du Loup, Que., G5R 4C2

Riviere Du Loup Clavigraphe (1979) Ltee. 383, rue Lafontaine, Riviere-du-Loup, Que., G5R 3B5 (418)862-7234 Apple, Canon, Olympia, Centronics, Epson, Micro

computer products, peripherals, accessories, software and furniture.

#### Roberval

Turcotte Antoine 789 Blvd. Marcotte, Roberval, Que. G8H 2A2

#### Rouyn

Centre D'Informatique Abitibi Inc. 338 Gamble O., Rouyn, Que., J9X 2R3

Logicon (Rouyn) Inc. 15 Gamble Est, Rouyn, Que., J9X 3B6 (819)762-7775 Computers sales. Computer installation. Data processing services. System programmation consultant.

#### Rosemere

Radio Shack 315 Boul. Labelle, Galeries des Mille Iles, Rosemere, Que., J7A 2A7 (514)437-1211 Radio Shack TRS-80 Models II, III, 16 and colour computers. Hardware and software plus related peripheral equipment.

#### Sept Iles

Services Informatiques de Sept-Iles Inc. 461 Brochu, Suite 202, Sept-Iles, Que., G4R 2X1 (418)968-8910 Commodore and 3M dealers for computer products. Books on computing from beginners to programmer. Software and games from various sources.

#### Shawinigan

Antras Micro-ordinateurs Inc. 553 Place Du Marche, Shawinigan, Que., G9N 1S3 (819)536-5823 Distributeur autorise Apple, Vifi sogiciel, 3M, Epson, Papier, Logiciel compatible, Apple, IBM, Commodore.

#### Sherbrooke

Compucentre
Carrefour de L'Estrie, 3050 Boul. Portland, Sherbrooke, Que., J1L 1K1 (819)562-2212
Personal computers from IBM PCjr, Commodore 64, Coleco Adam, plus complete line of peripherals, accessories and software for business entertainment and education applications. Large variety of books and third party vendor products.

Computerland 2524 Rue King Ouest, Sherbrooke, Que., J1J 2E8 (819)564-1534

D.O.S. Sherbrooke 1578 Rue King Ouest, Sherbrooke, Que., J1J 2C3

Futur Byte 1576 King St. West, Sherbrooke, Que., J1J 2C3 (819)564-1202 Consulting, analysis, programming, supplies. Authorized dealer for Apple, Commodore, Televideo, Xerox plus various lines of peripherals.

Les Systems Data du Canton Inc. Centre Commercial King, 2341 rue King Ouest, Sherbrooke, Que., J1J 2G5 (819)564-4448 Apple.

Radio Shack 3050 Boul. Portland, Carrefour de L'Estrie, Sherbrooke, Que., J1K 1L1 (819)562-3677

Visiontroniques Ltd. 218 Rue Alexandre, Sherbrooke, Que., J1H 4S7

#### Ste. Anne Des Mont

Dani-L'Ordinateur 26 Route Du Parc, Ste. Anne Des Mont, Que., G0E 2G0

#### St. Bruno

Compucentre
Promenade St. Bruno, 162 Boul. des Promenades,
St. Bruno, Que., J3V 5K1 (514)461-1121
Personal computers from IBM PCjr, Commodore
64, Coleco Adam, plus complete line of
peripherals, accessories and software for
business entertainment and education applications. Large variety of books and third party vendor products.

Micro-Mars Inc. 1364 Roberval St., St. Bruno, Que., J3V 5J2

Radio Shack 271 Boul. des Promenades, Les Promenades, St. Bruno, Que., J3V 5K3 (514)653-4122

#### St. David

Micro-Contact Inc. 463 Route 132, St. David, Que., G6W 1H5

Selectronic Levis 563 Trans-Canada Ouest, St. David Levis, Que., G6W 1H5 687-6525, 835-1515 MO

We stock Commodore, Sanyo, and Sony computers. Epson printers.

#### Ste. Foy

Compucentre 2700 Laurier Blvd., Ste. Foy, Que., G1V 2L8 (418)653-5150 Personal computers from IBM PCjr, Commodore 64, Coleco Adam, plus complete line of peripherals, accessories and software for business entertainment and education applications. Large variety of books and third party vendor products.

Computerland 2600 Boulevard Laurier, Ste. Foy, Que., G1V 2L1 (418)659-6540

Data Terminal Mart 1990 Ouest boul. Charest, Bureau 101, Sainte-Foy, Que., G1N 4K8 (418)687-3560

D.O.S. 3440 Quatre-Bourgeois, Ste. Foy, Que., G1W 4T3 (418)651-1882 MO

Also D.O.S. centres at Moncton, Montreal, Sherbrooke. We are also a builder for the Felix microcomputer.

Hewlett-Packard 2323 Blvd. Due Versant Word., Ste. Foy, Que., G1N 4P4

Irisco Du Quebec 1990 West Blvd., Charest #118, Ste. Foy, Que., G1N 4K8

MAI Canada Inc. 1963 Boul. Charest Ouest, Ste. Foy, Que., G1N 2E6

Micro-Logic Inc. 2796, Chemin Ste. Foy, Ste. Foy, Que., G1V 1V8 (418)658-6624

Ordinateurs IRISCO 2014 Boul. Charest Ouest, Suite 100, Ste. Foy Que., G1N 4N6 (418)681-0061 Commodore, Hewlett-Packard & Columbia

Ormic Ste. Foy 999 De Bourgogne, Ste. Foy, Que. G1W 4S6 (418)659-3858 Authorized: Apple, Commodore, Eagle, NEC, Gimix, Epson, Centronics, Sharp. Complete library, full software, supplies and Ormic diskettes. Complete line of computer furniture.

Radio Shack 2700 Boul. Laurier, Ste. Foy, Que., G1V 2L8 (418)658-7365

## **Directory of Computer Stores**

Radio Shack Computer Centre 2095 Charest Blvd. W., Ste. Foy, Que., G1N 4L8 (418)683-2149

Selectronic 2651 Hochelaga, Ste. Foy, Que., G1V 2J5

#### St. Gabriel De Brandon

Beaulieu Electronics 130 Dequoy, St. Gabriel De Brandon, Que., J0K 2N0

#### St. Georges de Beauce

Lariviere Electronics 11020 Lere Avenue, St. George De Beauce, Que., GSV 553

Les Ordinateurs PMC 12220 2nd Ave., St. George, Que., G5Y 1X4 (418)228-5504 Retailer of Televideo, Victor 9000, Sanyo, Epson, Okidata, C-ITOH, Hayes, and associate supplies. Software: specialize in business applications. Full

SYSMIC Ent. 11197-2 Leme Ave., St. Georges de Beauce, Que., G5Y 1V9 (418)228-0005

Microcomputer products, peripherals & accessories, software. Cdn. General Electric computer products, Memorex, Visicorp, Centronics. Authorized Apple dealer.

#### St. Hubert

Brosseau Ateliers 3256 Grande Allee., St. Hubert, Que., J4T 2S5

#### St. Hyacinthe

Microtast Inc.
740 Casavant West Blvd., St. Hyacinthe, Que., J2S
7S3 (514)773-1361
Everything for IBM, Commodore, Apple, Sharp
computers. JOLIDATA systems dealer. Hardware,
software, peripherals. Other store: 1275 des
Cascades, St. Hyacinthe, Que., J2S 3H2
(514)773-5858

Salon De L'Elect. 2783 Rue Nichols, St. Hyacinth, Que., J2S 2X2

Simco Inc. 2060 Des Cascades West, St. Hyacinthe, Que., J2S 3J6 (514)773-7843 Apple dealer. Peripherals and software. Apple only at 3 stores.

#### St. Jean sur Richelieu

Info Service Electronique Inc. 224 Champlain, St. Jean-sur-Richelieu, Que., J3B 6V8 (514)347-3375 MO Apple, GBC, Sharp, diskettes and accessories

Apple, GBC, Sharp, diskettes and accessories. Maintenance, customized systems.

#### St. Jerome

Academie De L'Ordin Carrefour Du Nord, 900 Blv. Grignon, St. Jerome, Que., J7Z 3S7

Infovideo Inc. 291 LaBelle, St. Jerome, Que., J7Z 5L2 (514)431-1414 Apple computers, Texas Instruments, Televideo systems, Epson, Comrex. Livres et revues.

#### St. Laurent

asap Computer Products 6969 Trans Canada Hwy., Suite 114, St. Laurent, Que., H4T 1V8 (514)337-2280

Authorized dealers for: IBM Personal Computer, Hyperion, IBM compatible software and hardware.

Compucentre 3131 Cote Vertu, Place Vertu, St. Laurent, Que., H4R 1Y8 (514)336-3058
Personal computers from IBM PCjr, Commodore 64, Coleco Adam, plus complete line of peripherals, accessories and software for business entertainment and education applications. Large variety of books and third party vendor products.

CompuDesign Le Bazar Shopping Centre, 3680 Cote Vertu, St. Laurent, Que., H4R 1P8 (514)335-2000

Dealer of Apple, Apple compatibles, IBM compatibles, Epson printers, peripherals and software for Apple and IBM, computer supplies and publications

Epson Canada Ltd. 6000 Vanden Abelle St. Laurent, Que., H4S 1R9

Hamilton Avnet 2670 Sabourin, St. Laurent, Que., H4S 1M2

JMT Inc. 2400 Modugno St., St. Laurent, Que., H4R 1W6 (514)337-6139

Lareon Micro Systems Inc. 3300 Cote Vertu, Ste. 108, St. Laurent, P.Q., H4R 2B8 (514)335-2725 Turnkey IBM and Apple systems. Accounting applications. Data entry. Hands-on end-user training.

MAI Canada Ltd. 7355 Trans Canada, Ste. 100, St. Laurent, Que.,

MBA Microsystems 627 Stinson St., St. Laurent, Que., H4N 2E1 (514)744-3376 We are a computer services organization. We do customized programs for small to medium size businesses, turnkey solutions on all brands of micro computers.

Protec Microsystemes Inc. 725 Decarie Blvd., Suite 202, St. Laurent, Que., H4L 3L4 (514)744-3363 MO CAT FREE Z-80 based micro computer kits, designed for teaching and industrial applications.

Radio Shack Computer Dept. 3205 Cote Vertu, Pl. Vertu Shop., St. Laurent, Que., H4R 1Y8 (514)332-0246

Radio Shack Computer Centre 8092 S. Service Rd., St. Laurent, Que., H4S 1M5 (514)337-2741

St. Laurent De L'Ord 835 Boul. Decarie, St. Laurent, Que., H4L 3M5

St. Laurent Micro Computers 824 Decarie Blvd., St. Laurent, Que., H4L 3L9 (514)744-4956 Timex/Sinclair, Franklin, Basis, Kaypro, Epson printers.

Universal Infor. 5990 Vanden Abelle, St. Laurent, Que., H4S 1R9

Xerox Ste.100, 7575 Place Trans Canadienne, St. Laurent, Que., H4T 1V6

#### St. Leonard

Universal Computer Systems 6955 Lacordaire, Suite 302, St. Leonard, Que., H1T 2K5 (514)255-5501 MO CAT FREE Computer distribution.

Zone 2000 Inc. CN 5130 Boul. Metro E., St. Leonard, Que., H1S 2V1

#### St. Philippe De Ne

Dionne Electronique 123 Route 230, St. Philippe De Ne, Que, G0L 4A0

#### St. Pierre De Sorel

Pierre Elect. Centre 201A Marie Victorin, St. Pierre De Sorel, Que., J3P 5J2

#### Ste. Ursule

Indusol Industrial Control Ltd. 2050 Rue Principale, Ste. Ursule, Que., J0K 3M0 (819)228-9500 MO

Indusol process control micro computers, Zenith data systems.

#### Stoneham

Micro Basic Systems \*2075 Tewkesbury, Stoneham, Que., G0A 4P0

#### **Thetford Mines**

Lessard Eq de Bureau 236 Notre Dame Sud, Thetford Mines, Que., G6G 1J6

Ordinatel 806 Champlain, Thetford Mines, Que., G6G 4A3

Ordinatel Inc. 236 Notre Dame Sud, Thetford Mines, Que., G6G 1J6 (418)338-2365 or 335-5172 Apple compatible, and Televideo line of computer and associate supplies.

Thetford Elect. 163-4th St. W., Thetford Mines, Que., G6G 5A3

#### Tracy

Pro-Micro 6870 Plaza Blvd., Tracy, Que., J3R 4L7 (514)743-2825

#### **Trois Rivieres**

Futur Byte 1366 Boulevard de Recollets, Trois Rivieres, Que., G8Z 4L5 Protucts: IBM, Commodore, Hyperion, Televideo, DEC. Printers: Epson, Centronics, Smith Corona. Software. Matteau Electronics 2045 Rue Royale, Trois Rivieres, Quebec, G9A 4L3

Micord Enterprises 1675 Royal, Trois Rivieres, Que., G9A 4K2 (819)373-2441

Ordinateurs Columbia, Kaypro. Imprimantes Epson, Brother. Logiciel, Produit informatique service de consultation.

Ormic Trois Rivieres 1500 Notre Dame, Trois Rivieres, Que., G9A 4X5 (819)373-7020

Authorized: Apple, Commodore, Eagle, NEC, Gimix, Epson, Centronics, Sharp. Complete library, full software, supplies and Ormic diskettes. Complete line of computer furniture.

Radio Shack 4375 Boul. Des Forges, Centre Les Rivieres, Trois Rivieres, Que., G8Y 5N9 (819)379-3036 Radio Shack TRS-80 Models II, III, 16 and colour computers. Hardware and software plus related peripharal equipment.

#### Valleyfield

Claude Gendron Elect. 173 Rue Victoria, Valleyfield, Que., J6T 1A6

Deltronic Solare Inc. ETI/CN 83 Rue Alexandre, Valleyfield, Que., J6S 3G7 (514)371-5720 Authorized Commodore, Televideo and G.A. dealer. Hardware, software and programmer service on-site

Magisystem Inc. 16 Rue Nicholson, C.P. 98, Valleyfield, Que., J6S 4V5

#### Val D'Or

Centre D'Informatique Abitibi Inc. 548-3rd Ave., Val D'Or, Que., J9T 1S4

#### Victoriaville

Co-Ordinateur 551 Inc. 551 Boul. Bois-Frances Sud, Victoriaville, Que., G6P 5X6

#### Ville D'Anjou

Compucentre (H.O.) 9200 Claveau, Ville D'Anjou, Que., H1J 1Z4 Head office is not an authorized dealer.

Compucentre (H.O.) 9001 Louis H. Lafontaine, Ville D'Anjou, Que., H1J 1Z4 Head office is not an authorized dealer.

#### Ville LeMoyne

Gregoire Elect. 200 Rue Charron, Ville LeMoyne, Que., J4R 2K6

#### **NEW BRUNSWICK**

#### **Bathurst**

Bayco Business Products Ltd. 212 Main St., Bathurst, N.B. E2A 1A9 (506)548-4558

Olivetti, Corona, Commodore computers. Printers by Epson, Okidata and Mannesmann-Tally. Specializing in legal and accounting software. Complete sales, service and support.

Business World Ltd. 379 St. Patrick St., Bathurst, N.B., E2A 1E2

#### Dieppe (Moncton)

Datamaster 438 Paul St., Dieppe, N.B., E1A 4Z2 (506)855-2277 Apple, Tl, DY-4 micros and local area networks. Specialize in business applications. Software, including proprietary software accounting package.

Computerland 550 Paul St., Dieppe, N.B., E1A 5T5 (506)855-6696 Retailer of IBM, Apple, Digital, Hyperion & Compaq hardware and software. Complete line of peripherals including Epson, Okidata, C-ITOH, Mannesman Tally printers. Full service centre onsite.

#### Fredericton

Concept Audio-Visuel 573 King St., Fredericton, N.B., E3B 1E8 (506)455-1119.

Computerland 1133 Regent St., Fredericton, N.B. E3B 3Z2 (506)454-1122 IBM, Compaq, Hyperion, Apple, Epson, Okidata, Lotus, Ashton-Tate. Full service and support.

414 York St., Fredericton, N.B., E3B 3P7 (506)454-8953 Apple, TI, DY-4 micros and local area networks. Specialize in business applications. Software, including proprietary software accounting package.

Interactive Computer Systems Ltd. 554 Queen St., Fredericton, N.B., E3B 1W9 (506)454-7691. MO

Retailer of IBM, Corona, Olivetti, Kaypro, Brother, Epson, Okidata. Specialize in business applications. Complete line of supplies and accessories for all micros. Full service department.

MacDonald Ventures (Sof Tec) Ltd. 30 Main St., Fredericton, N.B., E3A 1B8 (506)472-1678

BASF magnetic media distributor for the Atlantic provinces. Apple & IBM compatible computers. Customized software. Supplies and accessories for all micro computers.

Radio Shack 148 Dundonald St., Fredericton, N.B., E3B 1W8 (506)454-0930 MO CAT FREE

#### Moncton

D.C.T. Systems Inc. 15 Archibald St., P.O. Box 832, Moncton, N.B., E1C 5H8 (506)389-1222 Data consulting and timesharing (PDP 11/34) Xerox microcomputer and software. Pearl software, RDM Pascal data base, and micro peripherals.

Interactive Computer Systems Ltd. CN 827 Main St., Moncton, N.B., E1C 1G1 (506)389-3333

Retailer of IBM, Corona, Olivetti, Kaypro, Brother, Epson, Okidata. Specialize in business applications. Complete line of supplies and accessories for all micros. Full service department.

Radio Shack Computer Centre 801 Main St., Moncton, N.B., E1C 1G1 (506)854-2203 MO CAT FREE

TRS-80 computers and software. Printers, peripherals and user items.

#### CODING KEY

Codings are: MO (the company supplies mail order), CAT (catalogue available), Price is indicated if not free.

#### Saint John

Compucentre
Brunswick Sq. Fashion Centre, 1 Brunswick
Square, Saint John, N.B., E2L 4V1 (506)652-7580
Personal computers from IBM PCjr, Commodore
64, Coleco Adam, plus complete line of
peripherals, accessories and software for
business entertainment and education application. Large variety of books and third party vendor
products.

Datamaster 156 Union St., Saint John, N.B., E2L 1A8 (506)693-1132 Apple, TI, DY-4 micros and local area networks. Specialize in business applications. Software, including proprietary software accounting package.

Interactive Computer Systems Ltd. 28 King Street, Saint John, N.B., E2L 1G3 (506)693-7937 MO

Retailer of IBM, Corona, Olivetti, Kaypro, Brother, Epson, Okidata. Specialize in business applications. Complete line of supplies and accessories for all micros. Full service department.

Radio Shack Computer 621 Fairville Blvd., Lancaster Mall, Saint John, N.B., E2M 4X5 (506)674-1926 Complete line of TRS-80.

S&M Industrial Supply 220 Milford Road, St. John, N.B., E2M 4R4

#### **NOVA SCOTIA**

#### Armdale

Epson Canada Ltd. Box 4146, Armdale, N.S., B3L 4M7

Micro Computer Atlantic Box 20, Site 8, RR3 Armdale, N.S., B3L 4J3

#### Dartmouth

Computer Innovations Simpson's, 21 Mic Mac Blvd., Dartmouth, N.S., B3A 4K7 (902)465-3766 Authorized dealer for IBM, Apple and Compaq microcomputers. Line of printers include: NEC, Daisywriter, Epson, Toshiba, Mannesman Tally, C-ITOH. All major software packages.

Data Terminal Mart 800 Windmill Road, Dartmouth, N.S., B3B 1L1 (902)469-3782 Kaypro, DEC, Hewlett-Packard, Texas Instruments, Sperry computers; DEC, Qume, Hewlett-Packard terminals; Qume, DEC, Hewlett-Packard, Okidata printers; Hewlett-Packard Plotters; modems, cables, software.

MAI Canada Townsend Pl., Ste. 1151, 800 Windmill Road, Dartmouth, N.S., B3B 1L1

Mensa Computer Systems Ltd. #7-10 Akerley Blvd., Dartmouth, N.S., B3B 1J4 (902)469-1171. Full line Apple dealer carrying Apple //, Apple ///, Macintosh and Lisa. Specializing in service to small businesses. An authorized dealer for NEC computers.

Radio Shack Computer Centre 133 Wyse Rd., Dartmouth, N.S., B3A 4K9 (902)463-4910 or 463-4917 MO CAT FREE Classroom with educator in back of store, teaching computer courses, programming.

#### Greenwood

Innovative Systems Ltd.
P.O. Box 130 Greenwood, N.S., B0P 1N0 (902)765-4222
Apple computers, peripherals and software for Apple computers.

### **Directory of Computer Stores**

#### Halifax

Atlantis Microcomputer 1558 Argyle St., Halifax, N.S., B3J 2B7 (902)422-3500

Basic Computer Sales 6100 Young St., Halifax, N.S., B3K 2A4 (902)454-8344 MO CAT FREE

Texas Instruments TI-99/4A computers, peripherals and software, Okidata microline printers, Smith Corona and Panasonic. Hewlett-Packard calculators and PC's. Texas Instruments calculators.

Computer Access 5121 Sackville Street, Halifax, N.S., B3J 1K1

Computerland 6021 Young St., Halifax, N.S., B3K 2A1 (902)454-8676 MO

Retailer of IBM, Apple, Digital, Hyperion and Compaq hardware and software. Complete line of peripherals including Epson, Okidata, Hewlett-Packard. Full service centre and classroom facilities.

CPU Consulting 5161 George Street, #1016, Halifax, N.S., B3J 1M7

Mensa Computer Systems 1867 Granville St., Halifax, N.S., B3J 1Y1 (902)421-1127 MO

Lisa dealer carrying Apple computer products.

Dealer for NEC computers.

Minicomp Systems Ltd. 6174 Quinpool Road, Halifax, N.S., B3L 1A3 (902)421-7122 Full system Commodore dealer.

The Xerox Store 1809 Barrington St., Halifax, N.S., B3J 3K8 (902)425-6400 We sell Xerox 820-II, Xerox 16/8, Xerox 860, Hyperion, Apple Lisa, and Macintosh, as well as Diablo and Epson printers.

#### Kentville

Future World Computers Inc. 142 Aberdeen St., Kentville, N.S., B4N 4H8 (902)678-0101

#### Lunenburg

Bluenose Computer Shop 35 Falkland St., Lunenburg, N.S., B0J 2C0 (902)634-8856 MO Apple dealer.

#### **New Glasgow**

Brigadoon Enterprises 872 East River Road, New Glasgow, N.S., B2H 3S7

#### **New Minas**

Kobetek Systems Limited 1113 Commercial St., New Minas, N.S., B4N 3E6 (902)678-9800 MO CAT FREE

Commodore systems and Actrix portables. Distributor for Superclerk Integrated W/P, data manager and accounting package; statistical package for Commodore, coin control joysticks, Time Accountant for professionals.

#### **North Sydney**

Lantz Electronics Ltd. 115 King St., P.O. Box 459, North Sydney, N.S., B2A 3M5 (902)794-7273

Commodore and Corona PC dealer. Complete line of software. In-store custom programming and service/maintenance. Selection of peripherals.

#### Saulnierville

Orion Electronics Limited SauInierville, N.S., BOW 2ZO (902)769-3059 CAT FREE Dealers for Columbia computers.

#### Stellarton

Byte Control 263 Fiord St., Box 1615, Stellarton, N.S., B0K 1S0

#### Timberlea

Micro Computer Atlantic 2777 St. Margrets Bay Rd., Timberlea, N.S., B3L 4J3 (902)876-2920 MO

Jemini multi-user business sytem computers (TurboDOS), Qume video terminals, Seagate hard disks, Okidata printers, Transtar daisy-wheel printers, Elephant Memory Systems diskettes, Hayes modems.

#### Trure

Kelly's Electronic World CN 914 Prince St., Truro, N.S., B2N 1H5 (902)895-6674 Computer hardware and software sales and service representing Commodore, Epson, AVT, Silver Reed, Mannesmann-Tally, NEC and others

Yould's Limited CN 564 Prince St., P.O. Box 1319, Truro, N.S., B2N 5N2 (902)893-9481 MO CAT FREE

Victor 9000, Olivetti, Texas Instruments. Sales, service, leasing.

## PRINCE EDWARD ISLAND

#### Charlottetown

Jeta Systems Ltd. 33 Belmont St., Box 2857, Charlottetown, P.E.I., C1A 8C4

Megabyte ETI/CN 167 Queen Street, Charlottetown, P.E.I., C1A 4B1

Radio Shack Computer Dept. 96 Queen St., Charlottetown, P.E.I., C1A 4B1 (902)566-1443

#### Summerside

R.T. Holman Ltd. 250 Water St., Summerside, P.E.I., C1N 1B7 (902)436-2222 MO

Branch stores: R.J. Holman Ltd. Confederation Court Mall, Charlottetown P.E.I. R.T. Holman Ltd., Main St., Alberton, P.E.I.

#### **NEWFOUNDLAND**

#### Mt. Pea

Compu-Key P.O. Box 134, Mt. Pearl, Nfld., A1N 2C2

#### Stephenville

DSG Enterprises Ltd. Box 221, Stephenville, Nfld., A2N 2Z4

#### St. John's

Business Systems 108 Lemarchant Road, The Miller Bldg., St. John's Nfld., A1C 5L4 Caribou Computers P.O. Box 112, St. John's Newfoundland, A1C 5H5

Computerland 115 Ropewalk Lane, St. John's Nfld., A1E 4P1 (709)579-5126

J.W. Allan Co. Ltd. P.O. Box 1076, St. John's, Nfld, A1C 5M5 (709)726-3686 MO

Commodore software and hardware. Business systems. Educational systems. Consumer sales for 64 and Vic-20. Sales and service.

Micro-tech Computer Centre ETI Argyle Bldg., 25 Argyle St. and Avalon Mall, St. John's Nfld, A1C 5V5 (709)722-0782 or 722-8778 MO

Apple, Xerox and Kaypro. Cad: Houston instruments, Hewlett Packard. Applications: business and home sales and service.

Micro-tech Computer Centre Ltd. Avalon Mall, 54 Kermount Rd., St. John's, Nfld., A1B 1W3 (709)722-8778

Radio Shack Computer Dept. 48 Kenmount Road, Avalon Mall, St. John's, Nfld., A1B 1W3 (709)753-9340.

Technical Sales P.O. Box 1812, 62 Campbell Ave., St. John's Nfld., A1C 5P9

#### NORTHWEST TERRITORIES

#### Yellowknife

The Computer Centre 4813-49 Street, Yellowknife, N.W.T., X1A 2R1 (403)668-5175

#### YUKON

#### Whitehorse

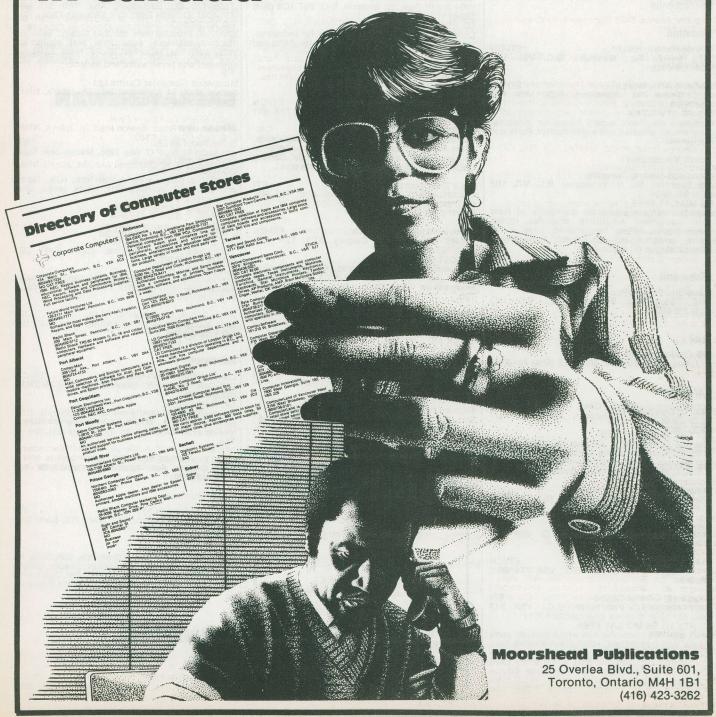
Total North Communications Ltd. 311 Black Street, Whitehorse, Yukon Y1A 2N1 (403)668-5175

Total North Communications Ltd. 311 Black Street, Whitehorse, Yukon Territory, Y1A 2N1 (403)668-5175

Complete scope of Apple //e, //c and Macintosh hardware. A broad selection of compatible software is stocked. Authorized service centre for //e, //c and Macintosh.

# **FALL** 1984

# Directory of Microcomputer and Electronic Retailers in Canada



## **Directory of Electronics Stores**

#### **BRITISH COLUMBIA**

#### Burnaby

RAE Industrial Elect.
3455 Gardner Court, Burnaby, B.C., V5G 4J7 (604) 291-8866
EC RTV TG EK MO CAT
West Coast distributor for: Hammond, Amphenol, Amp of Canada, National Semiconductor, Leader, RCA, Belden.

Innovative Electronics, 6993A Antrim Ave., Burnaby, B.C., V5J 4M5 (604) 430-5166

#### Nanaimo

Queale Electronics Ltd., ETI/CN 1925 Bowen Rd., Nanaimo, B.C. V9S 1H1 (604) 758-8166

Queale Electronics Ltd. ETI/CN 1925 Bowen Rd., Nainaimo, B.C., V9S 1H1 (604)758-8166 MO EC RTV TG EK
Complete electronic supply house for industrial commercial, amateur and experimenter. Parts and

#### **North Vancouver**

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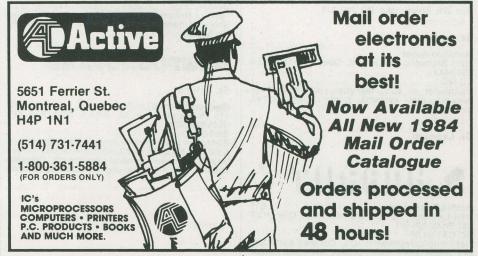
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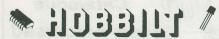
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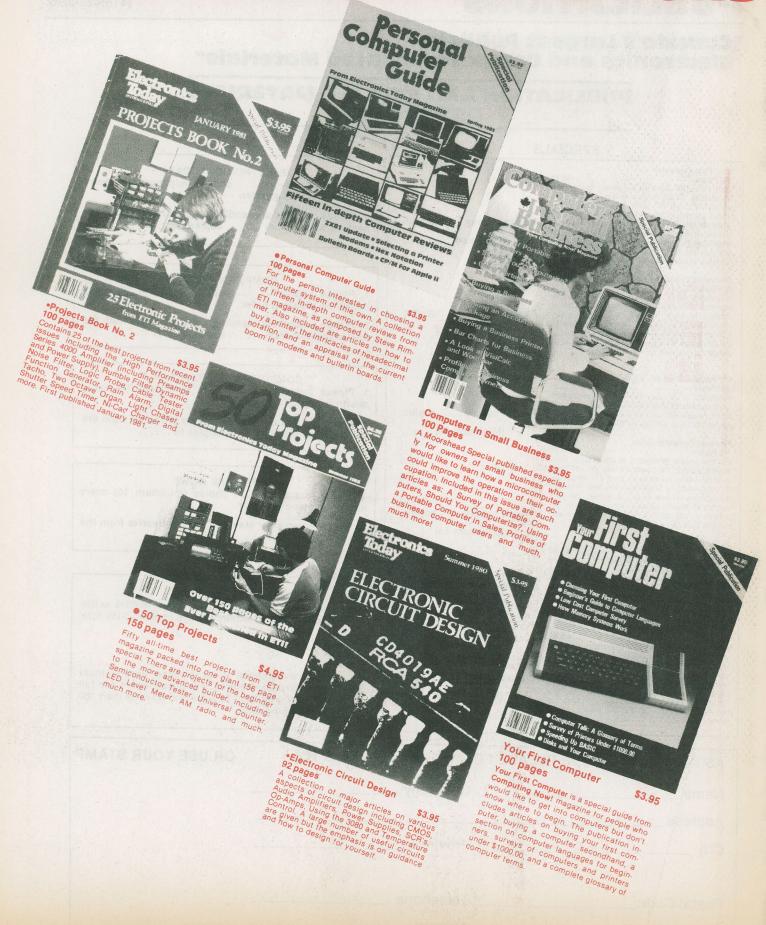
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here are a number of areas of programming which are turkeys to handle both in higher level languages and with an assembler... although usually for different reasons. String handling is one of these... BASIC and PASCAL are pretty decent at manipulating strings, but they do so very gracefully... with a dignified, glacial dirth of alacrity. Writing string handling stuff in assembler is a bit like bathing a hungry wombat in a tub full of cherry jello.

It's surprising how many people never get into either ex-

perience.

The lowly sorted directory program is a good example of one of those really nasty bits that doesn't come easily at either level. It would be impractical to boot BASIC and run the program every time one wanted to see what was on one's disk. However, there is some mind crackingly heavy code involved in doing it in assembler.

Rather than get too involved in the most practical solution, which is to distort the matrix of the time space continuum so that the BASIC implementation of this program appears to execute instantaneously... or even before you run it if you'd prefer... I figured that it would be a better learning experience to see how the assembler approach would transpire. This is not so slick as the Einsteinian mind warp, to be sure, but it uses less source code, decidedly an advantage.

Sheep

One of the things that's quite important in doing a magazine is not winding up with a "wall of type" effect. This is to say that you don't really want to have pages which are just line after line of copy with nothing to break it up, as it's hard to read. For this reason one generally introduces what are called *side heads*, those little black titles, every so often. It's not all that important that the side heads mean anything, and it's quite forgivable to simply use whatever comes into your head when one is needed. Just the other minute I was thinking about sheep.

However, I digress.

The sorted directory program, most often called D.COM, is one of the most useful utilities going. A typical version will read the directory listings, sort them alphabetically and present them with their approximate file sizes in K. Some directories will avail you of other information as well, such as the number of files on the disk and the amount of space they take up.

Despite the apparent complexity of this, it's possible to write such a program so that its eventual COM file occupies less than one kilobyte. Thus typing D will cause the directory to spill out onto your tube about as quickly as it would have, in a crude, un-

sorted form, if you had typed DIR.

There are, however, a number of problems to be overcome in getting all this together. In fact, the directory program is an interesting heap of code because it combines a number of diverse and generally useful routines. Having got a directory program together you will have several subroutines which can be used in later programs to do more impressive stuff, like counting air molecules or arranging the sum of man's knowledge in alphabetical order.

The component parts of a sorted directory are, in fact, a mechanism for getting the names of the directory entries into memory, another one for finding out how big the files are, a collection of trolls which can be goaded into sorting the entries alphabetically and, finally, a routine to print them out, converting their binary sizes into decimal representations.

The program shown here does all of that stuff. It's not a really great sorted directory... there's a better, and much faster, way of ascertaining the sizes of the files. However, this implementation will serve to illustrate how all this flotsam actually operates without

too massive a typing orgy... if you understand the structure of the program well enough you'll be able to add the required code involved in speeding it up.

```
Wombat Brothers Sorted Directory
Copyright (c) 1984 Steve Rimmer
This program may bring about
the cessation of causal reality
if used on a Commodore 64
BDOS
             EOU
              EQU
EL.
              FOU
                                         WHERE THE DMA BUFFER LIVES
MAXNUM
                                         MAXIMUM NUMBER OF ENTRIES ON A LINE
             ORG 0100H
                           START ; HOP OVER SUBS AND BUFFERS
                           CR,LF,9,9,' Steve''s sorted CP/M directory program',CR,LF,EL CR,LF,9,9,9,'+++ No file, Jack +++',CR,LF,EL CR,LF,9,'Drive'
HELLO
 NFILE
 SUMMARY
                            ', user area $'
contains $'
 CURDR
 SUM1
 SUM2
SUM3
                               (in $'
files.',CR,LF,EL
 SEP
                           '!$
CR,LF,EL
O,'?????????',0,0,0,0,0,0,0,0,0;HOME MADE FCB
OOOOH
;POINTER INTO ENTRY BUFFER
OOOOH
;ACCUMULATOR FOR TOTAL DISK USED
 CRIF
              DB
 FCB
BUFPNT
 WSPC
               DW
                                                       ;FAKE FCB FOR SIZE COMPUTATION
;NUMBER OF ENTRIES ON A LINE
;NUMBER OF FILES ON DISK
;BUBBLE SORT FLAG
  FRUF
  FLAG
              DB
               SUPPORTING CHARACTERS...
  ; SHOW THE FILE SIZE

PUSH H ! PUSH D ! PUSH B

LHLD BUFPNT ! LXI D,FBUF+1
                                                                     ;SAVE ALL REGISTERS
;POINT TO FCB & FAKE FCB
;11 BYTES IN A FILE NAME
               MVI B,11
               MOV A,M
STAX D
                                                                     ; MOVE NAME INTO BUFFER FOR SIZE
  NI.OOP
               INX H ! INX D ! DCR B ! JNZ NLOOP
               MVI C,35 ! LXI D,FBUF ! CALL BDOS LHLD FBUF+33
                                                                                  GET THE FILE SIZE FROM FAKE FCB
               MOV A,H ! CPI O ! JNZ DIVIT
MOV A,L ! CPI O ! JNZ DIVIT
JMP ZEROF
                                                                                   :ZERO?
                                                                                  ; IF SO, BYPASS ADJUST
; ADJUST SECTOR COUNT
               CALL DIVH ! CALL DIVH ! CALL DIVH LXI D,1 ! DAD D
  DIVIT
                                                                                   ROUND UP
                                                                     : PAD OUT LINE ...
  ZEROF
               PUSH
               STC ! CMC
LXI D,-100
DAD D ! JC SZ1
                                                                      ;CLEAR CARRY
;LESS THAN 100K?
;IF SO, PRINT A SPACE
;WITH CALL
                CALL
                             PAD
                PAD
POP H ! PUSH H ! STC ! CMC
LXI D,-10
DAD D ! JC SZ2
                                                                      ;GET VALUE BACK
;LESS THAN 10K?
;IF SO, ANOTHER PAD
  $21
                CALL
   $7.2
                            PAD
                                                                      AND ONE FOR LUCK & KARMA
                POP H ! PUSH H
XCHG ! LHLD WSPC
                                                                      ; POINT TO BUF, GET H IN D ; ADD THIS FILE AND SAVE
                DAD D ! SHLD WSPC ! POP H
                CALL DECOUT ;OUTPUT SIZE IN DECIMAL MYI C,2 ! MYI E,'K' ! CALL BDOS ;PRINT A 'K' POP B ! POP D ! POP H ;RESTORE THE REGISTERS
    :PRINT A SPACE
                PUSH H ! MVI C,2 ! MVI E,' ' ! CALL BDOS
POP H ! RET
    DIVH:
    ; DEVIDE H BY 2
ORA A ! MOV A,H ! RAR ! MOV H,A
MOV A,L ! RAR ! MOV L,A ! RET
    BURBLE:
    ;BUBBLE SORT THE DIRECTORY
SLOOP MVI A,O ! STA FLAG
LXI H,BUFFER ! LXI D,BUFFER+13
                                                                       ; RESET THE FLAG
; POINT TO 2 ENTRIES
; GET NUMBER OF FILES - 1
                 LDA FILES ! MOV B,A ! DCR B
                                                                       ;SAVE ALL REGISTERS;WHAT'S IN A NAME...;SAME LETTERS?
                 PUSH H ! PUSH D ! PUSH B
    MVI B,11
BLOOP LDAX D ! CMP M
```

### The Art of the Sorted CP/M Directory

```
JP NEXTENT
CMF M ! JM SWAP
DCR B ! JZ NEXTENT
INX H ! INX D ! JMP BLOOP
SET THE FLAG
SET HEE FLAG
SET HE FLAG
SET
```



```
MVI C.9 ! LXI D.CRLF ! CALL BDOS ! RET
DECOUT:
; VALUE IN HL WILL BE PRINTED IN DECIMAL ON THE TUBE
            JMP DECL
PUSH H ! PUSH D ! PUSH B
DEC1
           FOSH B : FOSH B : FVSH B LXI B,-10 ! LXI B,-10 ! LXI D,-1
DAD B ! INX D ! JC DEC2
LXI B,10 ! DAD B ! XCHC
MOV A,H ! ORA L ! CNZ DEC1
MOV A,E ! ADI 'O'
MVI C,2 ! HOV E,A ! CALL BDOS
POP B ! POP D ! POP H
            CALL
DECL
                       DEC1
            THE FEATURE ATTRACTION ...
 : GET PRAMETERS, IF ANY
            LDA 005CH ! STA FCB ! STA FBUF
                                                                          GET DISK PARM
             LDA 005DH ! CPI ' ' ! JZ NOPARM
LXI H,005DH ! LXI D,FCB+1 ! MVI B,11
                                                                           :SKIP IF NO SPECIFIER
                                                                           ;...OR POINT TO
;...DE TROLL &
             MOV A,M ! STAX D
INX D ! INX H ! DCR B ! JNZ PLOOP
PLOOP
                                                                           ; ... MOVE IT
            LXI H,0 ! DAD SP ! SHLD STACK ! LXI SP, STACK
 NOPARM
                                                                           ;SAY "HI WORLD"
             MVI C,9 ! LXI D, HELLO ! CALL BDOS
MVI C,26 ! LXI D, DMA ! CALL BDOS
                                                                           SET DMA BUFFER
             LXI H, BUFFER ! SHLD BUFFNT
MVI C,17 ! LXI D,FCB ! CALL BDOS
CPI 255 ! JZ NOFILE
                                                                            SEARCH FOR FIRST
                                                                            ; IF NO FIRST, SAY SO
             RLC ! RLC ! RLC ! RLC ! RLC LXI D,O ! MOV E,A ! LXI H,DMA DAD D INX H
                                                                           ; POINT TO ENTRY
; AND ADD TO POINTER
 SHOW
                                                               ;SKIP STATUS BYTE
;GET NUMBER BYTES IN NAME
             MVI
              XCHG
              T.HT.D
                         BUFPNT
                                                                GET POINTER INTO TABLE
                                                               ; INTO D ; MOVE THE NAME INTO THE BUFFER
                         A,M
 MLOOP
             MOV
              STAX
              INX H ! INX D ! DCR B ! JNZ MLOOP
```

```
SAVE H N D
                                                                  ; LEAVE ROOM FOR FILE SIZE
             INX H ! INX H
            SHLD BUFPNT ;
LXI H,FILES ! INR M ;
MVI C,12H ! LXI D,FCB ! CALL BDOS
CPI 255 ! JZ INBUF ;
                                                                  :STORE POINTER
                                                                   BUMP THE COUNT UP
                                                                  ; AND BLAST IT AGAIN
             JMP SHOW
; WE COME HERE, BOWING AND SCRAPING, WHEN THE TASK IS DONE
                                                                  SORT THE DIRECTORY
            CALL
                         BUBBLE
            LXI H, BUFFER ! SHLD BUFFNT
LXI H, FILES ! MOV B, M
                                                                   ....AND SAVE IT
                                                                   GET POINTER; SET UP 11 BYTES; AND PRINT THE
             MVI B,11
MOV E,M
MVI C,2
PUSH H! PUSH B
CALL BDOS
DLOOP
                                                                   : ENTRY
              POP B ! POP H
              DCR B ! JNZ DLOOP
             CALL SIZE
INX H ! INX H
SHLD BUFFNT
                                                                   ; SEE HOW BIG THE FILE IS
                                                                    SKIP THE BLANK
                                                                   ;UPDATE POINTER
              LDA COUNT ! CPI MAXNUM-1 ! JNZ NOCR
             CALL NEWLINE
MVI A,0 ! STA COUNT ! JMP GETNEXT
MVI C,9 ! LXI D,SEP ! CALL BDOS
                                                                                 ;DO IT IF NEEDS BE
;RESET COUNTER
;PRINT SEPARATOR
;BUMP COUNT
              IXI H COUNT ! INR M
                                                                                 : RESTORE COUNTER
                                                                                 ; ... AND SEE IF WE'RE DONE
              DCR B ! JNZ SEEBUF
              MVI C,25 ! CALL BDOS ADI 'A' ! STA CURDR
                                                                                 ·RETURN CURRENT DRIVE
              MVI C,9 ! LXI D,SUMMARY ! CALL BDOS
MVI C,32 ! MVI E,255 ! CALL BDOS
LXI H,0 ! MOV L,A ! CALL DECOUT
MVI C,9 ! LXI D,SUM1 ! CALL BDOS
                                                                                 START SUMMARY LINE
                                                                                 ;FETCH USER AREA
;SHOW THE GORY RESULTS
;CONTINUE WITH SUMMARY
               LHLD WSPC : CALL DECOUT ; PRINT TOTAL FILE SPACE
HVI C,9 ! LXI D,SUM2 ! CALL BDOS ; YET MORE SUMMARY
LDA FILES ! LXI H,0 ! HOV L,A ! CALL DECOUT ; NUMBER OF FILES
HVI C,9 ! LXI D,SUM3 ! CALL BDOS ; FURTHER ADVENTURES
                           OHIT
                                                                                 : AND WE GONE
 NOFILE MVI C,9 ! LXI D,NFILE ! CALL BDOS
QUIT LHLD STACK ! SPHL ! RET
                                                                                  ; SAY NO FILE, JACK
                                                                                  RESTORE STACK
                                         ;OLD STACK POINTER;START OF DIRECTORY ENTRY BUFFER
 BUFFER DS
```

#### Sheepware

The structure of this program is a bit atypical, in that all the subroutines and fixed stuff are at the top. This is actually a pretty good way to debug code like this, as most of the multilegged beasties show up in the subroutines. The main code, after START, is really pretty straight up.

Herding along to the details...

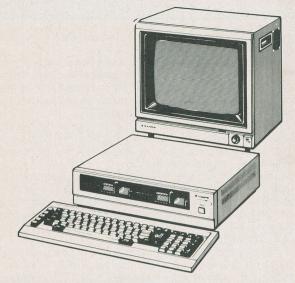
There are actually a couple of ways to get the disk directory information into memory... the one which I've used here is the simplest. It involves the application of a couple of BDOS calls.

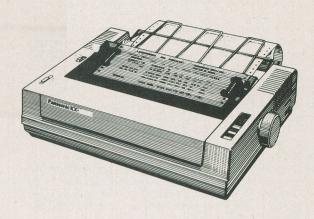
The BDOS provides a way to search for the first occurrence of a file and, thereafter, to search for all subsequent occurrences. Since a file name can contain ambiguous references... wild cards to the plebs... there can be more than one occurrence of any given name.

When you tell CP/M to do something to a file called \*.\* it creates a file control block... the FCB... which holds eleven question marks. That's eight for the name and three for the extension. A specification like FLAT\*.CAT would translate into FLAT????CAT. This, however, is different from FLAT.CAT, which would come out as FLAT CAT... the latter contains no ambiguity, and, as such, would feature no question marks.

The first thing the directory program will want to do is to find out if, having been called, it is supposed to show the entire directory or just selected highlights. If you type D B: \*.CAT you will want it to spew out a directory of drive B for all files of the extension CAT

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### The Art of the Sorted CP/M Directory

This specification is handled by CP/M by its placing a drive byte at location 5CH and the file name, padded out with question marks, beginning at 5DH. As such, it's fairly easy to use... we just pinch the drive byte and, optionally the file name unless the first byte of it is a space... in which case no file name was specified.

The program contains its own FCB, cleverly labelled "FCB", which is initialized with question marks. If no file name is found at location 5DH this will fly as it is. If there is a name it will be used to

replace this total ambiguity.

Flinging BDOS call seventeen will cause the disk directory to be searched for the file in the FCB. If it isn't found the system will return 0FFH in the accumulator. Otherwise it will return an offset. The name itself will turn up somewhere in the DMA buffer.

The offset... yes, that did slip by rather quickly, didn't it... is the offset of the name of the file you asked for from the beginning of the DMA buffer, set here to 80H... well, sort of. Actually, to get the real offset you have to multiply A by thirty—two and add one. The multiplication is actually pretty simple... one just does five RAL... rotate left... instructions.

# Flinging BDOS call seventeen will cause the disk directory to be searched for the file in the FCB.

Adding the resultant value of A to 80H will point to the first byte in an eleven byte file name meeting the specification given in the FCB. Having thus found the name one can move it to someplace safe. This arrangement is as funky as a lawyer on acid, to be sure.

Having once searched for a first instance of the file one can thereafter search for as many other occurrences as exist on the disk using the number eighteen BDOS call. It works in essentially the same way as the previous one, returning OFFH in the accumulator when it finally runs out of entries.

This program throws these calls and places the resulting file names in a buffer... really just the memory after the last bit of the program. When the last call has echoed into the sunset the thing breaks out of its main directory loop and starts thinking about displaying its new found booty.

The files come off the disk in the order in which they were put on, rather than alphabetically. As such, it's necessary to rearrange them in the buffer, or, in the proper techno-babble, to *sort* them.

Sheepsort

Actually, the sorting technique used in this program is less of a sheepsort than a bubble sort. The sheepsort technique... placing a bucket full of sheepslop in one corner of a pasture full of hungry sheep and determining the fastest sheep by noting which ones get there first... is somewhat inapplicable to many programming applications as bytes don't run.

There are a number of kinds of sorting techniques... magazines like this one run articles about them from time to time. If you're a devotee of sorts you'll know that bubble sorting in among the least efficient of them. However, it's relatively easy to code and, with the relatively small number of potential entries as is

found in a disk directory a faster sort would make no perceptible

The principal behind a bubble sort is that you scan through a list of entries. Assuming that you want to sort them into ascending numerical... or alphabetic... order, you look at each entry and the one immediately following it as a pair. If the pair is in the wrong order you swap them and set a flag.

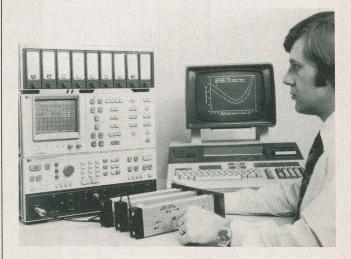
When the entire list has been scanned the bubble sorting routine looks to see if the flag is set. A set flag will send it back to reset the flag and run through the list again. In this way the entries

will "bubble" up through the stack.

The bubble sort here is actually a pretty short one... I was rather pleased with it. It has a bit of a catch in it inasmuch as it must determine which of two strings should come first. In other words, it must look at the first two characters and, if they turn out to be the same look at the next two and the next two and so on until it finds two that don't match.

When the list has been sorted all that's left is to display the contents of the now reshuffled buffer in a useful manner. The directory will print each file name and its size in kilobytes.

The size specification presents two problems, to wit, finding it and showing it in decimal. The first is handled with a BDOS call which returns the number of sectors in the file in question in the FCB. This is not a very good way of handling this, as it's easily



confused and quite slow. However it will suffice for this example.

The size routine returns the sector count, which is eight times larger than the the kilobyte count would be. One adjusts this with three calls to the DIVH routine, which performs a sixteen bit right rotate on the HL register.

The DECOUT routine is one which has been pinched from the BIGMAC macro library presented in the July 1984 edition of Computing Now!. It's fairly straight up, recursively slicing up the H,L register until it gets down to the units.

Virgin Wool

There's a lot of fairly useful code in this program... even if you already have a more sophisticated D.COM. It should serve to illustrate a number of the trickier aspects of machine language programming... you can take these simple calls and rewrite dBASE II by yourself if you have a mind to.

You can also make this directory into much neater and slicker directory programs, spewing out all manner of information about the files being DIR'd. We'll be looking at more interesting direc-

tories in a future issue of Computing Now!.

# There Are Other Ways To Get CN!

Getting into your Kodiak foot sarcophogia and your goose filled parka . . . be sure to stun the geese first . . . and trudging out across the frozen tundra to the newsstand for your copy of Computing Now! may seem like a drag. For one thing, you have to trudge all the way back to your shack before you can check out the latest news, applications, software and equipment reviews.

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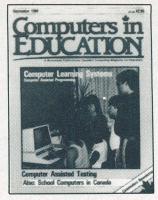


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Computers in Education is Canada's magazine for the teacher or others involved with microcomputing and comes from Moorshead Publications, the publishers who became industry leaders with Electronics Today, Computing Now!, and soon Software Now!.

There are news articles on the latest events and technology, beginner's guides to languages and software, software and book reviews, build-it-yourself projects, technical

tips, and more.

In recent issues, for instance, Computers in Education covered the Icon educational computer and user's reactions to it, Logo, word processing for the classroom, simple cures for hardware problems, how disk systems work, a BASIC tutorial and more.

See Order Card in this issue

# **Book** of the Month

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# **COMPUTER PRESS**

# Computer Faire Statistics

TORONTO, ONTARIO — In the final settling of the dust at the recent *Toronto Computer Faire* several cubic miles of statistical information was amassed. One compilation was of data concerning the magazines read by the show's attendees. Here's a quick tabulation:

### Model 2000 Upgrade

BARRIE, ONTARIO — Owners of *Tandy*'s TRS-80 Model 2000 can get even greater software compatibility with the IBM PC and other compatibles. **PC Maker**, a program offered free to all registered Model 2000 owners, allows MS-DOS or PC-DOS disk file transfers between the Tandy computer and either the IBM PC or similar compatibles.

The Tandy line of microcomputers is available at local Radio Shacks.

# **New PC Products**

DON MILLS, ONTARIO — In addition to its new PC AT, *IBM Canada* has announced three new items for better PC productivity.

The PC Network allows the linking of up to 72 IBM PC's for program, peripheral and general information sharing. PC XENIX, a multi-user, multi-tasking version of AT&T's UNIX was introduced with applications programs. A multi-tasking program, Topview, allows PC users, through the use of windows, to operate in as many environments simultaneously as memory permits.

#### Software R&D

VANCOUVER, B.C. — The Canadian Association of Data Processing Service Organizations feels that the costs incurred in the development of software designed for sale to third parties should be tax deductible.

President Bill Boggs, during a meeting in Vancouver, stated that the federal government had been urged by the association to change its policy regarding software development costs.

The association feels that, excepting post-sale maintenance costs, software development can be categorized, and should be tax deductible, as research.

#### PCjr WordStar

SAN RAFAEL, CALIFORNIA — Following IBM's introduction of an improved typewriter keyboard for their PC-jr, *MicroPro International Corporation* has made a version of **WordStar** available to PCjr users.

Selling for \$195 in American funds, the program permits disk-based file transfers between the jr and IBM PC.

Dirty drive heads are a major reason for data loss. *Budgetron Inc.*, is the exclusive Canadian distributor of **RSI Computer Care** products. Available are the computer care kit for terminal and disk drive maintenance, the wet process diskette kit and a dry process diskette...

Circle No. 51 on Reader Service Card.



A 16-bit upgrade for the TRS-80 Models I, III, 4 and 4P computers, *Micro Projects Engineering*'s **Xcaliber** allows user to read, write and execute much of the available software for the IBM PC. When combined with an optional video display card, programs such as Lotus 1-2-3 and MultiMate may be run...

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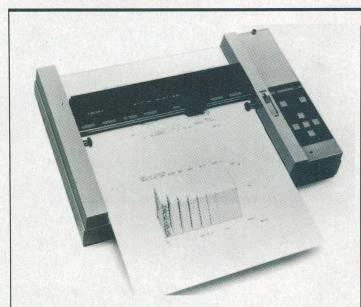
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440 millimetres across, the plotter is available from *RCC Electronics*...

Circle No. 53 on Reader Service Card.

Hardware support for Apple's Macintosh is becoming more plentiful. **MacModem**, *Micro*-

com, Inc's latest offering, is an intelligent 1200 baud modem with communications software. Supporting both autodial (in either touch tone or pulse) and auto-answer, the direct connect modem can be upgraded to 2400 baud...

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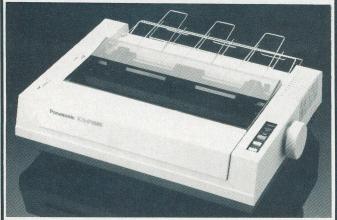
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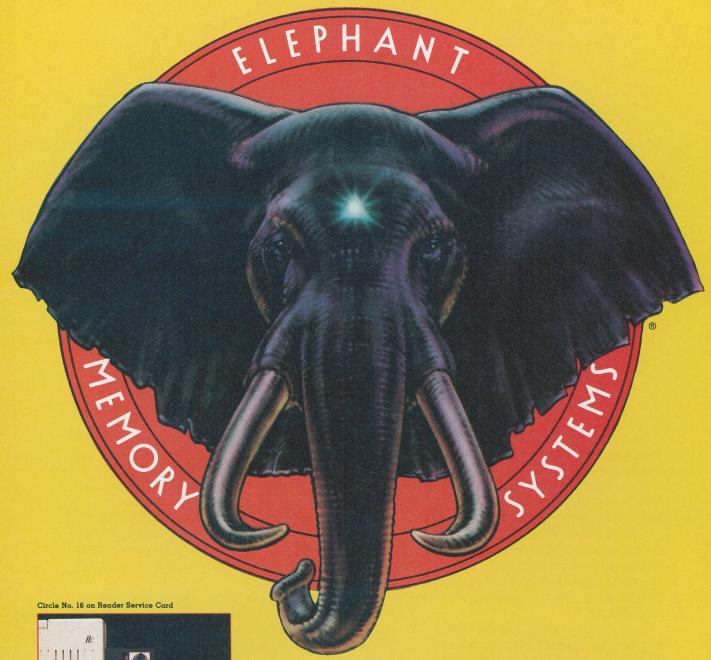
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